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No. 1779

HANDBOOK OF THE
6-INCH HOWITZER MATÉRIEL
MODEL OF 1908 AND 1908MI
WITH INSTRUCTIONS FOR ITS CARE

(TWENTY-FIVE PLATES)

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JANUARY 1, 1913
REVISED AUGUST 1, 1917



WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

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G.W.I.



WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ORDNANCE,
Washington, August 1, 1917.

This manual is published for the information and government of the Regular Army
and National Guard of the United States.

By order of the Secretary of War:

WILLIAM CROZIER,
Brigadier General, Chief of Ordnance.

(3)

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For additional equipment furnished the headquarters company of a regiment see pamphlet, Form No. 1796.

¹ Will be issued when available.

² This temporary pack outfit is furnished to batteries for the purpose of carrying the fire-control equipment, until such time as a type of 2-horse reel, to be built for this purpose, is available.

HANDBOOK OF THE 6-INCH HOWITZER MATÉRIEL.

THE 6-INCH HOWITZER, MODEL OF 1908.

(Class IV, Section 3.)

WEIGHTS, DIMENSIONS, ETC.

Weight.....	pounds..	1,925
Caliber.....	inches..	6
Total length.....	do....	87
Length of bore.....	do....	81.5
Length of rifled portion of bore.....	do....	69.05
Rifling—		
Number of grooves.....		54
Depth of grooves.....	inches..	.05
Width of grooves.....	do....	2091
Width of lands.....	do....	.14
Twist-right-hand, uniform one turn in 18 calibers.		
Weight of projectiles, filled and fuzed.....	pounds..	120
Weight of powder charge.....	do....	3.75
Weight of cartridge case.....	do....	8
Capacity of powder chamber.....	cubic inches..	291
Muzzle velocity (zone 3).....	feet per second..	900
Maximum pressure per square inch.....	pounds..	20,000
Maximum range.....	yards..	6,704
Travel of projectile.....	inches..	71.95

DESCRIPTION.

The howitzer is built up of nickel steel, consisting of the body and the breech hoop. The breech hoop envelops the breech end of the body and projects beyond it to form the breech recess or seat for the breech mechanism. The breech hoop is joined to the breech end of the body by means of screw threads, and in addition to being screw threaded is put on with a shrinkage. The breech hoop has a lug at its extreme end which projects upward and forms a point of attachment for the recoil and counter-recoil devices. Along the entire length of the howitzer in the upper right and left hand quadrants are two clips which are finished as guide rails. The surface of these guide rails is parallel to the bore of the body, and, fitting into the gun slides of the carriages, directs the howitzer during recoil and counter recoil.

BREECH MECHANISM.

(Class IV, Section 3.)

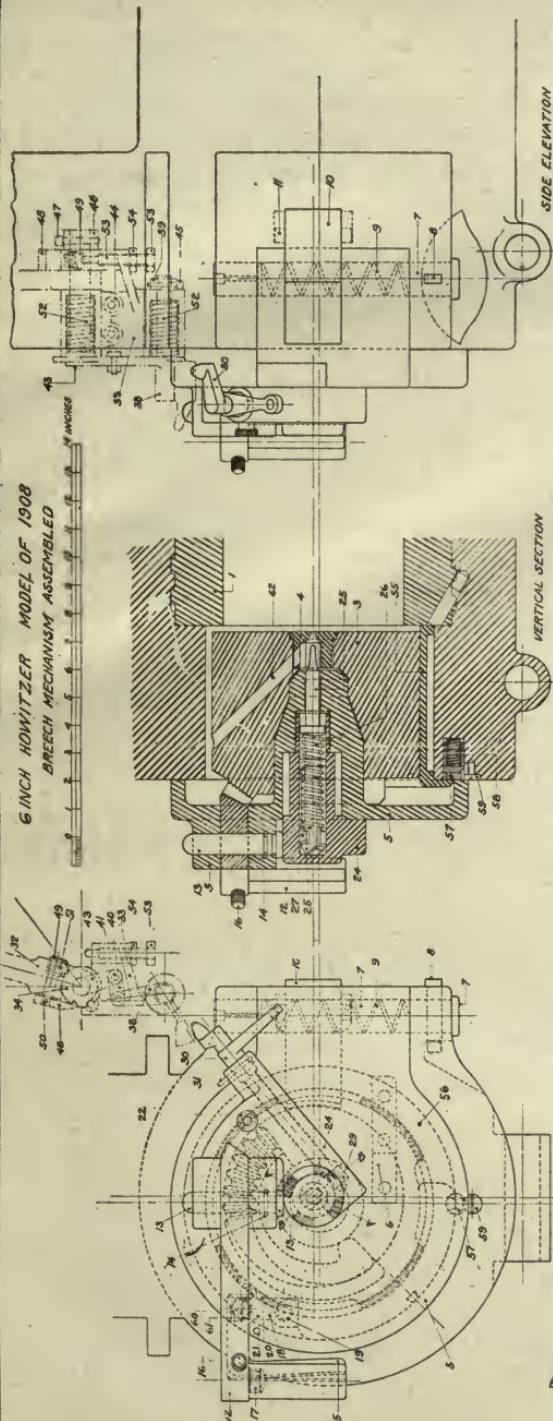
(Plate I.)

The breechblock is of the interrupted-screw type and is provided with four-threaded and four-slotted sectors. The front end of the axial recess in the block for the hub of the block carrier is closed by a bushing. Two vent holes leading from a cavity in the bushing rearwardly through the breechblock permit the escape of gas from a ruptured primer. On a semicircular boss on the rear face of the breechblock are cut gear teeth, in which the gear teeth of the operating lever bevel gear mesh. The lower end of the circular boss on which the gear teeth are cut serves as a stop to limit the rotation of the block to the unlocked position. This lower end of the circular boss comes in contact with a hardened steel stop riveted to the inner face of the block carrier. A radial lug or tooth projects from the inner surface of the breechblock and engages an L-shaped groove cut in the hub of the block carrier, so that when the mechanism is unlocked no relative movement between the breechblock and carrier can take place. In order to surely maintain this relation between the breechblock and block carrier, a block latch, pivoted on the inner face of the carrier in the upper left-hand quadrant, engages a notch or shoulder cut in the rear face of the block adjacent to the boss on which the gear teeth are cut. This latch is so pivoted that as the mechanism is swung free from the howitzer it moves forward sufficiently to engage the notch in the block and also to cause the forward plane of the latch to project forward of the front face of the block carrier; consequently when the mechanism is swung to the closed position the front face of the latch comes in contact with the rear face of the breech of the howitzer, thus forcing the latch out of the notch in the breechblock back into a recess in the carrier, and by continuing the motion of closing the mechanism the breechblock is free to rotate on the hub of the carrier and engage its threads with those in the howitzer.

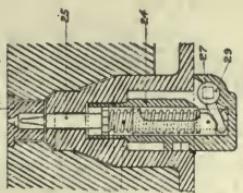
When the breechblock is in the locked position a lug on the firing-lock case engages the front face of the tooth or lug on the breechblock, which locks the breechblock to the carrier. This engagement between the lug on the breechblock and the lug on the firing-lock case serves to lock the carrier to the breechblock and prevent displacement due to a blowback. This is accomplished through the medium of four additional lugs on the firing-lock case, which are arranged to interlock with corresponding lugs on the carrier. The breechblock is mounted eccentrically in the breech of the howitzer, with reference to the axis of the bore, and is concentrically mounted on the hub of the block carrier, in which the firing-lock case is fitted.

**6 INCH HOWITZER MODEL OF 1908
BREECH MECHANISM ASSEMBLED**

6 INCH HOWITZER MODEL OF 1908
BREACH MECHANISM ASSEMBLED

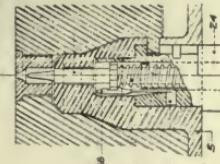


SIDE ELEVATION



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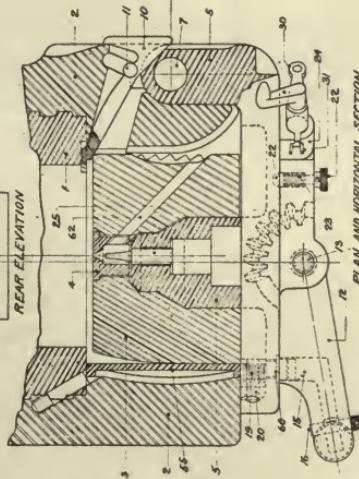


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EAST

VERTICAL SECTION

REAR EVALUATION



22

The firing-lock case is eccentrically fitted in the hub of the block carrier in such a position that the axis of the firing pin is always in line with the bore of the howitzer. The bushing in the front end of the breechblock, through which the firing pin passes, when in the fired position, is fitted eccentrically with reference to the breechblock and is provided with a cavity of such dimensions that the breechblock is permitted to revolve about the firing pin, which is fixed in the hub of the block carrier and does not rotate. The point of the firing pin, when at rest, is always within the enlarged cavity in the bushing, and when the block is revolved to the unlocked position the hole in the bushing through which the point of the firing pin passes is moved to one side, due to the eccentric arrangement of the breechblock, thus masking the point of the pin and preventing any possible contact between the firing pin and the primer in the cartridge case when the block is unlocked. The block will be practically locked before any contact between the firing pin and primer can take place. The firing pin is provided with a shoulder a short distance in rear of its forward end, which comes in contact with the rear face of the bushing if an attempt is made to fire the howitzer when the breech is unlocked. This is to prevent any possible blow coming on the point of the firing pin and injuring the same.

The loading tray is located in the breech recess and serves to protect the two lowest threaded sectors in the breech recess from being bruised by the ammunition when loading the gun. Its middle portion is cut away in order to clear the lowest threaded sector on the block when the latter is closed. It is locked to the gun when the breech is open by the tray latch, which is located in the rear lower face of the breech hoop, and engages a slot in the rear lip of the tray. The latch is so placed that as the carrier strikes the face of the breech it forces the latch to disengage its seat in the tray. As the block rotates its lowest threaded sector, which engages the tray, causes the latter to rotate its front and rear lip, sliding on seats in the breech recess provided for that purpose.

FIRING MECHANISM.

The firing mechanism belongs to that type known as a continuous-pull mechanism; that is, no cocking of the firing pin is required other than a pull on the lanyard or a downward pressure of the firing handle. This arrangement permits of repetition of the blow from the firing pin in case of a misfire as often as desired, without the opening of the mechanism or recocking the firing pin.

FIRING PIN.

The firing pin is mounted in the firing-lock case and near its front end is provided with a collar which serves to guide the pin axially and as a shoulder for the front end of firing spring, and also serves as

a means for locking the firing pin by the sear until the firing spring has been compressed by the action of the firing mechanism and the sear released. The rear end of the firing pin is rectangular in cross section and is provided with a double lug against which the trigger fork engages at a point between its upper end and its axis. The engagement serves as a means of withdrawing the firing pin to its retracted or normal position, after the pin has been released and forced forward. Opposite the double lug for the trigger fork the firing pin is provided with another and smaller lug, which fits into a slot in the firing-spring sleeve and serves to hold the sleeve in its proper position.

FIRING SPRING.

The firing spring is threaded over the firing pin from the rear end of the pin, and over this is assembled the firing-spring sleeve in such a manner that when it is seated in its proper position the firing spring is put under an initial compression by being compressed between the collar on the front end of the firing pin and a shoulder or seat formed on the inside of the sleeve at its rear end.

SEAR.

The sear, which is in the form of a leaf spring, is seated in a slot in the firing-lock case and is provided with a thickened forward end, into which is cut a notch, in which a hardened portion of the periphery of the collar on the firing pin engages. Just to the rear of this notch in the sear an inclined surface is provided, upon which the forward end of the firing-spring sleeve acts in its forward motion to compress the spring and fire the piece. After the sleeve has traveled the required distance to produce the proper compression to the firing spring, the sear is forced outward, thus releasing the engagement between the sear and the collar on the firing pin. On the rear end of the sear a cylindrical projection is formed, which fits into a hole drilled into the firing-lock case. This serves to hold the sear in place.

TRIGGER FORK.

The trigger fork is seated in the rear end of the firing-lock case and is constrained from displacement laterally by the walls of the case, and is mounted on the upper squared end of the trigger shaft. The trigger fork is bifurcated on the end which engages the firing pin and sleeve, and it is seated so that the flat sides of the firing pin pass between the bifurcated end of the fork, and the rear face of the bifurcated ends bears against the front edge of the double lug on the firing pin at a point located between the end of the trigger fork and its axis. This point of contact between the firing pin and trigger fork is important, as it helps to maintain the proper operation of the firing pin in its return action after firing. The extreme bifurcated ends of the

trigger fork are rounded, and these ends bear against a flat surface on the rear end of the firing-spring sleeve perpendicular to the axis of the sleeve. The fork does not touch the sleeve at any other point. The firing spring is under compression at all times and exerts an equal pressure between the collar on the front end of the firing pin and its seat in the rear end of the firing-spring sleeve. The pressure on the firing-pin collar is transmitted to the trigger fork at the bearing between the latter and the double lug on the firing pin, while the pressure on the spring seat in the sleeve is transmitted to the trigger fork at its extreme bifurcated ends. These two forces are constantly equal and opposite in direction, but have different lever arms with respect to the axis of rotation of the fork. The fork is, therefore, acted upon by a varying couple, the amount of which is sufficient when the trigger shaft is released to rotate the trigger fork to the rear, carrying with it the firing pin through the medium of the double lug on its rear end. This motion continues until the firing-pin collar engages the sear, at which time the spring, sleeve, trigger fork, and firing pin are in their normal positions and the firing mechanism again ready for action.

TRIGGER SHAFT.

The trigger shaft is assembled in a projection which forms a part of the firing-lock case and is held in place by a wire detent. It has at its lower end a squared portion on which the trigger fork is mounted. At its upper end are two projections, the longer of which is provided with a hole for the attachment of a lanyard, by which the gun should be fired until the spade at the end of the trail is sufficiently embedded in the ground to hold the carriage in place. The other projection on the trigger shaft is acted upon by the firing pallet, which is mounted in the firing-handle bracket. The firing pallet is connected by the firing link to the firing shaft on which is mounted the firing handle. This combination of parts serves as a means for firing the howitzer from a seat on the trail.

FIRING-LOCK CASE.

The firing-lock case contains the complete firing gear, and if necessary the entire firing mechanism can be replaced in an instant. It contains the firing pin, firing spring, firing-spring sleeve, sear, trigger fork and trigger shaft, and detent. It is provided with four lugs, by which it is locked in place in the hub of the block carrier, and one lug which is forward of the other four, which engages behind a lug on the breechblock. This lug, together with the other four which lock the casing to the carrier, serves to lock the block and carrier together. The firing-lock casing is held from displacement due to rotation by a spring catch or lock bolt. This lock bolt is fitted in a projection of the casing and its inner end enters a recess or seat in the rear face of the block carrier.

OPERATING LEVER.

The handle and body of the lever is recessed to receive the lever latch. The inner end of the lever is provided with beveled gear teeth, which mesh with corresponding teeth on the breechblock and serve as a means for opening and closing the mechanism. The lever is seated between two lugs on the block carrier, and is held in place by a pivot.

BLOCK CARRIER.

The block carrier is hinged on its right side to the howitzer by means of the hinge pin. It is provided with a central, inwardly projecting hub, upon which the breechblock is concentrically mounted. The hub is bored out eccentrically to receive the firing-lock case, which is held in place from axial displacement by four lugs formed on the inside of the bore. In the forward end of the hub a slot is cut which extends to the rear and terminates in an L. This receives the lug on the breechblock and holds the block from displacement when the mechanism is open. Two lugs are formed on the rear face of the carrier just above its center. They form a seat for the operating lever. On the inner face in the upper left-hand quadrant a seat and pivot for the block latch is provided. In the lower right-hand quadrant on the inner face a hardened steel block stop is riveted. This limits the rotation of the block in the open position. In the lower circumference are drilled three ventholes for the escape of gas in case of a blowback. A catch for the operating-lever latch is suitably located and screwed to the rear face of the carrier. It is held in place by a small pin driven in from the circumference of the carrier. On the right side of the carrier a recess is formed which serves to operate the extractor.

EXTRACTOR.

The extractor is located in the extractor seat. It is operated by the right face of the carrier, the bottom of the recess in the latter serving to give it a quick throw at the end of the swing of the carrier in opening the mechanism. The extractor rolls on its forward or convex face and is prevented from being displaced by its trunnions, which slide in grooves formed in the top and bottom of the extractor seat. A lip on the extractor engages the rim of the cartridge case and serves as a means of ejecting the same.

OPERATING-LEVER LATCH.

The latch is fitted in a seat in the operating lever and serves to lock the handle from rotation, which in turn prevents rotation of the block. The latch is held in place by a steel pivot.

HINGE PIN.

This is a hardened steel pin ground to fit, and is held from displacement by a hinge-pin key through hinge pin and lower hinge lug.

ACTION OF THE BREECH MECHANISM.

To open the breech, grasp the operating lever handle; at the same time compress the lever latch handle. This releases the latch from the catch on the block carrier. Rotate the operating lever to the rear. During the first part of this movement ($76^{\circ} 30'$) the block and loading tray are rotated to their unlocked position, at which time the stop on the block comes in contact with the stop on the block carrier and the tray latch opposite its seat in the loading tray. The block latch will drop into its notch in the block and the tray latch engage the tray at the moment of swinging the carrier from the howitzer. The block is now locked against further rotation in either direction. During a further rotation of the operating lever of about 100° the block and carrier swing about hinge pin clear of the breech recess, the right face on the carrier operates the extractor, unseating the cartridge case before the end of the 100° movement, and finally ejects the case free of the howitzer. When another round is inserted the rim of the cartridge case comes in contact with the extractor and forces it partly home. In closing the mechanism the movements are simply the reverse of opening; as the block carrier comes in contact with the breech face of the howitzer, the block latch is forced rearward, the tray latch forward, unlocking the block from the carrier and the loading tray from the breech hoop. Further rotation of the operating lever rotates the breech block and loading tray, causing the threads of the former to engage those of the howitzer. This engagement of threads moves the block forward, due to the pitch of the threads, and firmly seats the cartridge in the howitzer. At the final motion of the operating lever its latch engages the catch on the rear face of the block carrier, locking the block in the closed position. The howitzer is now ready to fire.

TO DISMANTLE THE FIRING MECHANISM.

Take hold of the knurled head of the locking bolt situated at the upper part of the firing lock case; pull it to the rear; then revolve the firing lock case downward about 45° and pull it gently to the rear. This will remove the case with the firing mechanism complete from the howitzer. Press the trigger-shaft detent until it disengages from the notch in the firing-lock case. This will allow the trigger shaft, with its detent, to be withdrawn. Then gently press on the front of the firing pin, forcing it back into the casing. This will allow the trigger fork to fall out. Then, with one finger placed on the front end of the sear, force it outward; at the same time grasp the front end of the firing pin. Give it a sharp pull. This will remove the firing pin with its spring and sleeve from the casing. Then place the front end of the firing pin against a block of wood, bear down on

the firing-spring sleeve until the spring is compressed sufficiently to disengage the slot in the rear end of the sleeve from the small lug on the rear end of the firing pin, slightly pull outward the sleeve, and it can then be separated from the spring and pin. By an unscrewing motion the spring can be removed from the pin. The sear can be removed by gently pressing it in toward the center of the casing.

To assemble, reverse these operations, taking care before driving too hard on the end of the trigger shaft that the square hole in the trigger fork is in position to receive the tapered end of the trigger shaft. No tools are required for assembling or dismantling this mechanism.

TO DISMANTLE THE BREECH MECHANISM.

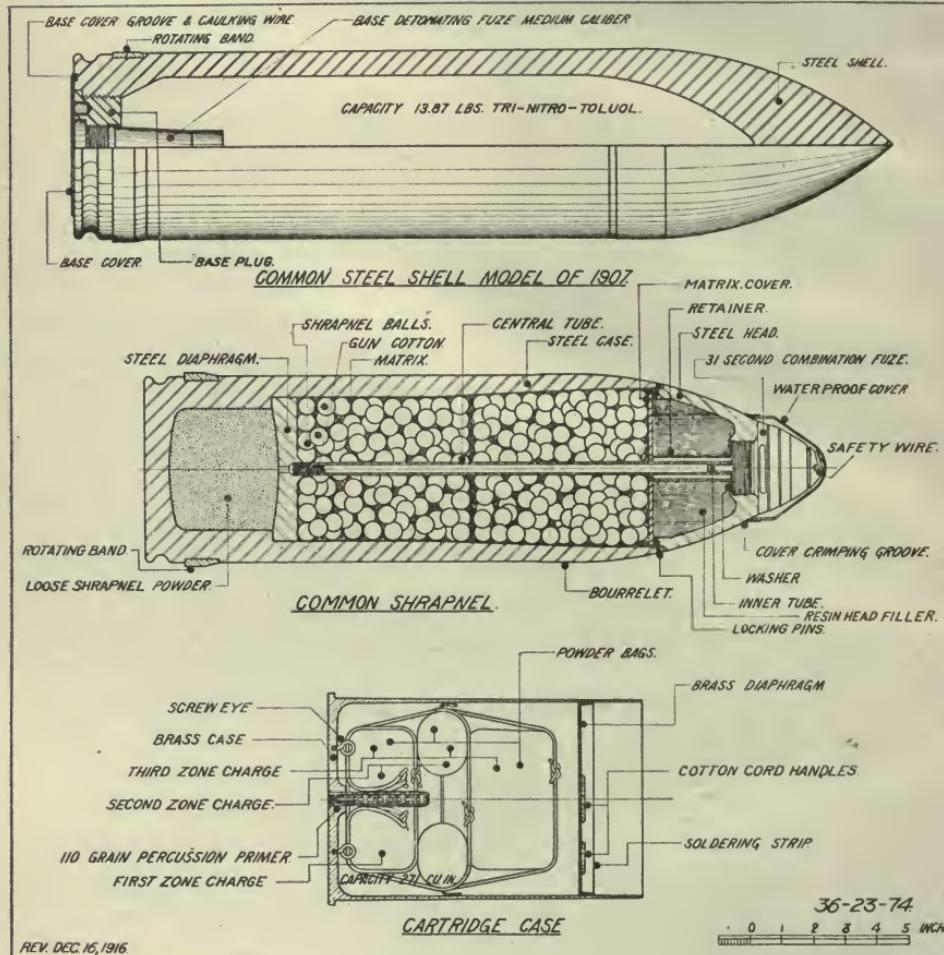
Grasp the operating lever and open the mechanism; when the mechanism is open force the block latch out of its seat in the block by gently pressing it into its seat in the carrier. Take hold of the block and revolve it to the left until it stops; then pull it to the rear, taking care not to drop it. The block latch can now be readily removed. After the firing-lock case has been removed, the operating lever can be removed by forcing its pivot down from above by a gentle pressure with the palm of the hand. The lever latch can be removed by pressing in on the latch at a point near its lower end opposite its pivot; a hole in the latch is cut eccentric with reference to the pivot, and a shoulder on the pivot prevents their displacement until the latch is forced in until the hole is concentric with the pivot. When this occurs the pivot can be readily pulled out and the latch removed. To remove the block carrier, pull out the hinge-pin key in lower part of hinge, push the hinge pin down by hand until it can be caught by the head, and by swinging the carrier back and forth, if the pin sticks, it can readily be removed. The extractor can now be removed from the howitzer.

Pressing on the tray latch sufficiently to force it in its seat permits the loading tray to be removed from the breech recess. Reverse these operations for assembling the mechanism. Nothing but the hands are required for dismantling this breech mechanism.

CARE OF THE HOWITZER.

After firing, the bore of the howitzer should be cleaned to remove the residue of smokeless powder, and then oiled. In cleaning, wash the bore with a solution made by dissolving one-half pound of sal soda in one gallon of boiling water. After washing with the soda solution wipe perfectly dry, and then oil the bore with a thin coating of the light slushing oil furnished for the purpose. A slush brush for use in oiling the bore will be issued by the Ordnance Department upon requisition.

Plate II



The breech mechanism should be kept clean and well oiled. It should be dismounted from time to time for examination and oiled when assembled. The spare parts carried in the trail box or in the battery wagon should be well coated with vaseline or heavy oil and each piece then wrapped in paper to prevent the oil from being rubbed off.

AMMUNITION.

(Class VI, Sec. 3.)

Separate loading ammunition with brass case is used in the 6-inch howitzer and is made up with either common shrapnel or common steel shell. The ammunition chests of the battery are of sufficient size to take any of the rounds furnished so that the number of each kind to be carried is a matter for regulation by proper authority.

Each projectile is issued filled and fuzed. The weight of the projectile is 120 pounds and the total weight of one complete round is approximately 132 pounds. The components of one round are the cartridge case with primer, powder charge, diaphragm, and the projectile with base cover and fuze.

A cast-iron shell has been designed having the same center of gravity and the exterior dimension as the common steel shell.

A design for a high-explosive shrapnel is being developed with a view to its adoption to supersede the common shrapnel.

THE CARTRIDGE CASE.

(Plate II.)

The cartridge case is a solid drawn brass case 9.93 inches long; it has a capacity of 271 cubic inches under diaphragm and weighs with primer 8.11 pounds. The head of the case has a projecting flange or rim under which the lip of the extractor engages. The center of the head is bored out to form a seat into which the primer is forced. These primer seats are first mandreled to near the finished dimensions with a tapered steel plug to toughen the metal of the cartridge case around the primer seat and then reamed to finished size. This toughening is necessary to prevent expansion of the seats under gas pressure and consequent loose fit of the primers in subsequent firing. The primers are inserted in the case by the large primer inserting press to avoid injury to the primer seat. Special decapping tools are also issued for use in removing exploded primers from cartridge cases.

Base is stamped with name and model of howitzer, initials of place, and date of manufacture, and ammunition lot number.

THE PRIMER.

(Plate II.)

To insure the ignition of smokeless powder charges in cartridge cases it is necessary that the primers either contain in themselves in addition to the percussion composition an auxiliary charge of black powder, or that an auxiliary charge of such powder be placed at the rear of the cartridge case to communicate the flame from the percussion primer and thoroughly ignite the smokeless powder. The percussion primer, known as the "110 grain percussion primer," contains an igniting charge of 95 grains of black powder in addition to the essential elements of a percussion primer.

The "110-grain percussion primer" is shown in Plate II and consists of a brass case resembling in shape a small-arms cartridge case. The head or rear end of the primer case is countersunk, forming a cup-shaped recess, in which is seated the cap or percussion primer proper. The latter consists of the cup, the anvil, and the percussion composition assembled as shown on Plate II. The percussion composition is known as the "H 42" mixture and contains the following ingredients:

	Per cent.
Flowers of sulphur.....	21.97
Sulphide of antimony.....	30.83
Chlorate of potash.....	47.20

The percussion-cap recess is connected with the interior of the primer case by a small axial vent. The body of the case contains 95 grains of black powder, constituting the rear priming or igniting charge for the smokeless powder propelling charge. This black powder is inserted under a pressure of 2,400 pounds per square inch and is pressed into the primer body around a central wire, which is then withdrawn, leaving a longitudinal hole the full length of the primer. Eight radial holes are drilled through the primer and compressed powder, affording 16 vents for the free exit of the black powder flames. After filling the body the front end is closed by two cardboard wads waterproofed with shellac. The radial perforations in the body of the case are covered by a tin-foil wrapper, shellacked on, to retain in the case any loose black powder, as well as to exclude all moisture.

In action, the blow of the firing pin explodes the percussion cap, which ignites the black powder; the flames of the latter shoot out through the vents in the primer case and ignite the smokeless-powder charge.

A shorter primer, known as the "saluting primer percussion," is issued for use in blank cartridges. The percussion elements and dimensions of the seat in the cartridge case for both types of primers are identical. The primer charge of the saluting primer consists of

20 grains of loose rifle powder, held in place by a paper wad shellacked in the mouth of the primer case.

The "20-grain saluting primers" are issued in hermetically sealed tin boxes, 25 in a box. The boxes should not be opened nor the cases primed until shortly before they are required for use.

The large primer-inserting press is provided for inserting both types of primers, which must be carefully pressed, and not hammered, into their seats in the cartridge case. Special decapping tools are also issued for removing old primer cases from cartridge cases without injury to the latter.

THE POWDER CHARGE.

The powder is a nitrocellulose powder composed of multiperforated (seven perforations) cylindrical grains packed in three silk cartridge cloth bags to provide for the three zones of firing. The full charge of the three bags will be generally used for all ranges. The reduced charges are provided for cases where a greater angle of fall is necessary in order to reach some object behind cover.

When the full charge is used, the cartridge case is inserted without removing the diaphragm. The diaphragm has very little range when fired from the howitzer. Reduced charges are obtained by tearing off the soldering strip and removing the diaphragm, together with one or two powder bags, according to which zone is required.

The powder bags are distinguished in the following manner: The bag placed in the bottom of the cartridge case is known as the "inner charge bag" and is stamped "1," and contains about 22 ounces of powder. The bag in the middle is known as the "middle charge bag" and is stamped "2," and contains about 13 ounces of powder. The bag at the top directly under the diaphragm is known as the "outer charge bag" and is stamped "3," and contains about 25.25 ounces of powder. The total varies in different lots of powder, but is approximately 3 pounds, 12.25 ounces.

The powder bags are held in place by means of glazed jute or flax twine placed through special screw eyes in the head of the cartridge case. The heads of the screw eyes consist of two helical coils in place of the usual ring. In making up the cartridge the twine for the middle charge bag is first passed under the heads of the screw eyes and the ends laid over the edge of the cartridge case. Two pieces of twine are passed through the fabric at the front end of the inner charge bag and tied. The ends are then passed through the hole for the primer, passed under the screw eyes, and brought up outside of the bag; one end of each string is then tied across the top of the bag and the free ends laid over the edge of the cartridge case. The middle charge bag is then placed in position and secured by the twine first placed under the screw eyes; in tying the middle charge bag the twine is first threaded through the holes in the ends of the

handle and tied over the top of the bag. The remaining ends of twine are used to secure the outer charge bags in a similar manner, after which the diaphragm is inserted and secured in place by the soldering strip.

Shrapnel should not be fired for canister effect with inner zone charges and 0 fuze setting, as the personnel of the firing detachment would thereby be endangered, due to a possible rearward movement of the shrapnel case, the case velocity arising from the bursting charge being sometimes greater than the muzzle velocity. In firing shrapnel for canister effect, the full charge should be used both for the above reason and for the purpose of securing the greatest and most effective ball velocity.

Smokeless powder must not be used for blank charges. For this purpose the Ordnance Department furnishes special powder.

PROJECTILES.

COMMON STEEL SHELL.

(Plate II.)

The common steel shell is provided with an ogival head struck with a radius of 2 calibers, and is fitted with a copper rotating band forced into the annular groove 1.25 inches from the base.

The base of the shell is tapped for the medium caliber base detonating fuse and is fitted with a copper base cover secured in the base cover groove by the calking wire. The base cover consists of a copper cover, lead disk, lying between the cover and the projectiles, and a lead calking wire. This base cover seals the joint between the fuze and shell against the entrance of powder gases into the shell cavity. The common steel shell contains a bursting charge of 13.87 pounds of trinitrotoluol. The weight of the shell with bursting charge and fuze is 120 pounds. The shell is always issued filled and fuzed.

SHRAPNEL.

The common shrapnel is a base charged shrapnel fitted with a combination fuze. The case is of steel with a solid base. The rotating band is forced into an annular groove cut in the case 1.25 inches from the vase. The front or mouth of the case is closed by a steel head, screwed in and tapped to take the service 31-second combination time and percussion fuze. The bursting charge is composed of a charge of loose black powder (1.31 pounds). The bursting charge thus arranged is covered by a steel diaphragm. The diaphragm supports a brass central tube which extends forward to the fuze, and thus affords a conduit for the flames from the fuze to the bursting charge. At the lower end of the central tube a stopper of dry gun cotton is fitted to assist the ignition of the bursting charge and to prevent the loose powder charge from getting into

31 SECOND COMBINATION FUZE MODEL OF 1907 M.

FIG. 1.

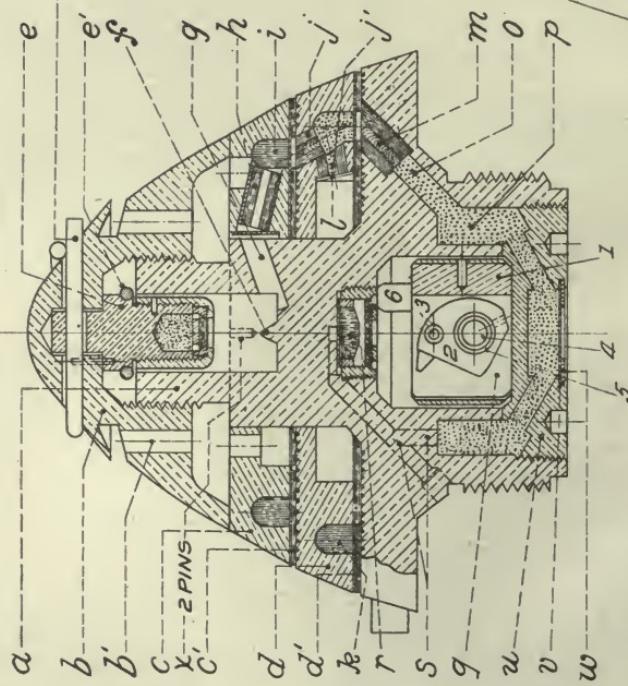
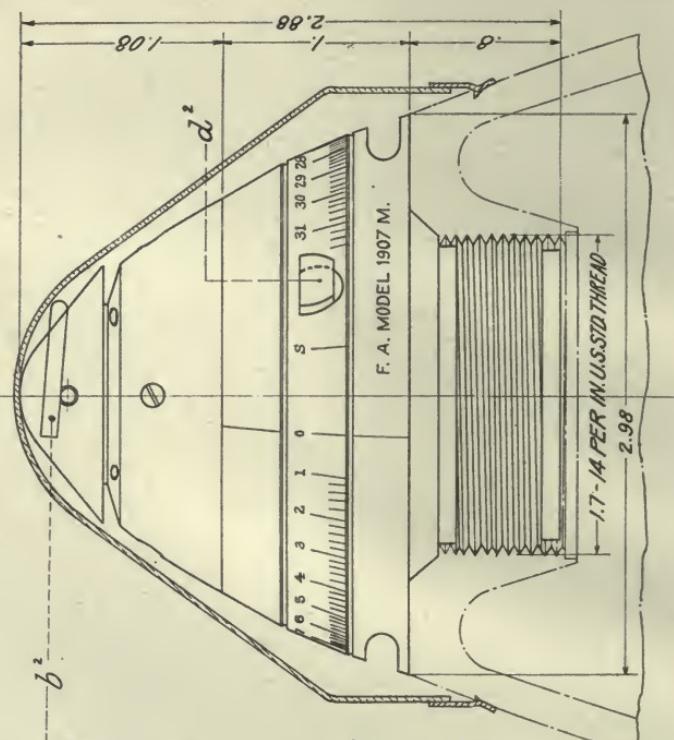


FIG. 2.



36-23-69

the tube. The shrapnel filling is composed of 1,084 balls, each approximately 306 grains in weight. The interstices contain a smoke producing matrix.

In action, the case is not ruptured upon the explosion of the bursting charge; the head is stripped and the balls are shot out of the case with an increase in velocity.

All shrapnel ammunition is issued fuzed, ready for use and provided with a waterproof cover to exclude moisture.

FUZES.

(Class VI, Section 3.)

COMBINATION FUZES.

These fuzes are point fuzes with combination time and percussion elements for use with shrapnel. They are of the type known as the ring or "dial" fuze, in which the time train is set by turning a graduated ring which carries part of the time train. These fuzes may be reset as often as desired.

FRANKFORD ARSENAL 31-SECOND COMBINATION FUZE.

(Plate III.)

This fuze consists of the following parts, assembled as shown in the drawing:

- a* Body, bronze.
- b* Closing cap, brass.
- b'* Vents in closing cap.
- b²* Safety wire.
- c* Upper time-train ring, Tobin bronze.
- c'* Washer for time-train ring, graduated, felt cloth.
- d* Time-train ring, graduated, Tobin bronze.
- d'* Washer for body, felt cloth.
- d²* Rotating pin, brass.
- e* Concussion plunger.
- e'* Concussion-resistance ring, brass.
- f* Firing pin.
- g* Vent leading to upper time train.
- h* Compressed powder pellet.
- i* Upper time train, compressed powder.
- j* Compressed powder pellet, in vent leading to lower time train.
- j'* Compressed powder pellet in lower time-train vent.
- k* Lower time train, compressed powder.
- l* Brass disk, crimped in place.
- m* Compressed powder pellet in vent *o*.
- o* Vent leading to magazine.
- p* Powder magazine.
- q* Percussion plunger.
- r* Percussion primer.
- s* Vents leading from percussion primer to magazine.
- u* Bottom closing screw, brass.
- v* Washer for closing screw, muslin.
- w* Washer for closing screw, brass.

The body *a* of this fuze is machined from a bronze forging. The time-train rings *c* and *d* are turned from hard-rolled rods of Tobin bronze. An annular groove in the shape of a horseshoe is milled in the lower face of each of the time-train rings. Meal powder is compressed into these grooves under a pressure of 51,000 pounds per square inch, forming a time train.

The time element of this fuze is composed principally of the following parts: The time or concussion plunger *e*, the concussion resistance ring *e'*, the firing pin *f*, the vent *g* leading to the upper time train, the compressed powder pellet *h*, the upper time train *i*, the vent *j*, the lower time train *k*, the compressed powder pellet *m* in the vent *o* leading to the powder magazine *p*.

The plunger *e* is cylindrical in shape, and contains the percussion composition in a recess at its base. The weight of the plunger rests upon the concussion-resistance ring *e'*, which keeps the primer from contact with the firing pin. At discharge of the gun the resistance of the ring is overcome and the primer is exploded by contact with the firing pin.

As stated above, the annular grooves into which the meal powder of the time train is pressed are in the shape of a horseshoe, a solid portion being left between the ends of the groove in each ring or disk.

The upper time-train ring *c* is prevented from rotating by pins which are halved into the fuze body and the inner circumference of the ring.

The vent *g* is drilled through the walls of the concussion-plunger chamber, and is exactly opposite a hole in the inner surface of the upper time train leading to the end of the train from which the direction of burning is anticlockwise.

The hole *j* is drilled through the upper face of the lower time-train ring *d* to the end of the lower time-train groove, from which the direction of burning is clockwise. The lower time-train ring is movable, and is graduated on its outer edge in a clockwise direction from 0 to 31; these divisions are subdivided into 5 equal parts. A radial pin *d²* is provided in the lower ring for engagement with a notch in the fuze setter for setting the fuze. A line on the lower flange of the fuze stock is the datum line for fuze settings.

The vent *o* is drilled through the flange of the fuze stock to the powder magazine *p*, and leads to the same end of the lower time train as the vent *j*—that end from which the direction of burning is clockwise—when the fuze is at its “zero” setting.

The action of the fuze as a time fuze is as follows:

Assume, first, the “zero” setting as shown on the figure. At discharge of the gun the concussion plunger arms and fires its primer. The flame from the primer passes out through the vent *g*, igniting the pellet *h*, the end of the upper time train *i*, down through the

vent *j*, to the end of the lower time train *k*, and thence through the vent *o* to the magazine *p*, the flame from which is transmitted to the base charge in the shrapnel. It will be seen that for the "zero" setting of the fuze the origin of both upper and lower time trains are in juxtaposition. Assume any other setting, say, 12 seconds: The vent *j* has now changed its position with respect to the vent *h*, leading to the beginning of the upper time train and the vent *o*, leading to the powder magazine *p*, both of which points are fixed by the angle subtended between the 0 and the 12 settings. The flame now passes out through vent *g* and burns along the upper time train in an anti-clockwise direction until the vent *j* is reached, where it passes down to the beginning of the lower time train and burns back in a clockwise direction to the position of the vent *o*, whence it is transmitted by the pellet of compressed powder *m* to the powder magazine *p*.

For the 31 setting the vent *j*, leading to the beginning of the lower time train, is opposite the end of the upper time train and the end of the lower time train is opposite the vent *o*, leading to the powder magazine. It will now be seen that to reach the magazine *p* and burst the shrapnel the entire length of the time train in both rings must be burned.

As already stated, the annular grooves in the lower face of each ring for the powder trains do not form complete circles, a solid portion being left between the ends of the grooves in each. This solid portion is utilized to obtain a setting at which the fuze can not be exploded, known as the "safety point."

This point is marked by a line on the outer edge of the movable time train, surmounted by an "S," and is located about halfway between the zero mark and the 31-setting graduation. When this point is brought opposite the line on the lower flange of the fuze body the vent *j* is covered by the solid metal between the ends of the upper train, and the vent *o*, leading to the powder magazine *p*, is covered by the solid metal between the ends of the lower or movable time train.

At the safety setting it will be seen that the upper train may burn entirely out in case of accidental firing of the time plunger, or in case it may be desired to burst the shrapnel by impact or percussion, without the flame being able to reach the magazine *p*.

The cloth washers *c'* and *d'* are glued to the upper face of the time train ring and to the upper face of the flange on the fuze stock. These surfaces are corrugated, as shown, to make the washers adhere more strongly. The function of the washers is to make a gas check and prevent premature action of the fuzes.

The compressed pellet *j'* in the vent leading from the outside to the beginning of the lower time train is to release the pressure of the gases due to the burning train. The gases from both time trains

escape into the outer air through the annular spaces shown in the illustration and the vents b' in the closing cap.

The percussion element of this fuze, as shown in the plate, consists of a centrifugal percussion plunger q and an ordinary percussion primer r .

The system of vents through the walls of the fuze shown in figure 3 conduct the flame from the percussion primer to the magazine p .

The bottom closing screw closes the percussion plunger recess and keeps the powder in the magazine. The muslin washer v is coated with shellac and held in place by the brass washer w , over the outer edge of which a projecting lip is crimped.

These fuzes are issued assembled in shrapnel. For transportation in limbers and caissons the fuze should always be set at the safety point.

The fuze is provided with a waterproof hood of thin brass, hermetically sealed. The hood should be stripped off before an attempt is made to set the fuze.

CAUTION: Whenever a round of shrapnel ammunition has been withdrawn and the safety wire b^2 removed from the point of the fuze it should never be replaced in the ammunition chest until the safety wire has been reassembled in the point of the fuze in order to lock the concussion plunger in place.

HAND-FUZE SETTER, MODEL OF 1913.

(Plate IV.).

DESCRIPTION.

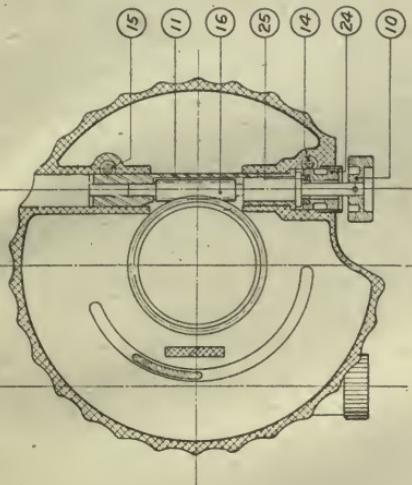
1. The hand-fuze setter is a device for rapid and accurate setting of the time burning of the fuze for various ranges and heights of burst.

2. For the list of nomenclature see page 29. Plate IV shows assembled and sectional views and designation of parts.

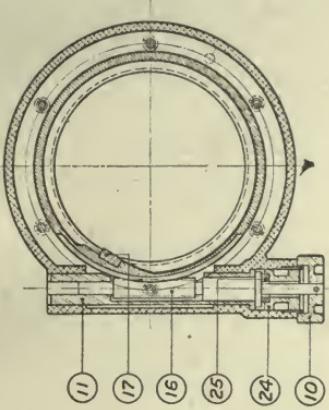
3. The hand-fuze setter provided for the 6-inch howitzer consists principally of an aluminum case (1) having a serrated rim forming a handle for turning; a range ring (12) mounted on the range ring carrier (23), which is operated by the knob (10) on the worm (16); a corrector scale (20), mounted on the corrector scale support (22), is operated by the knob (10) on the worm (16) and a guide plate (21) which rests on the projectile.

4. A slot is cut in the range-ring carrier (23) which engages with the pin on the graduated time-train ring of the fuze. A stop pin (17) is attached to the corrector-scale support (22) and engages with the stop pin of the fuze to limit the motion of the fuze setter.

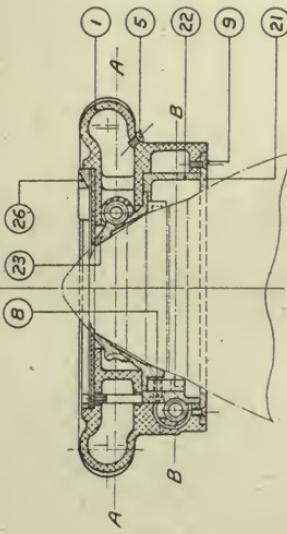
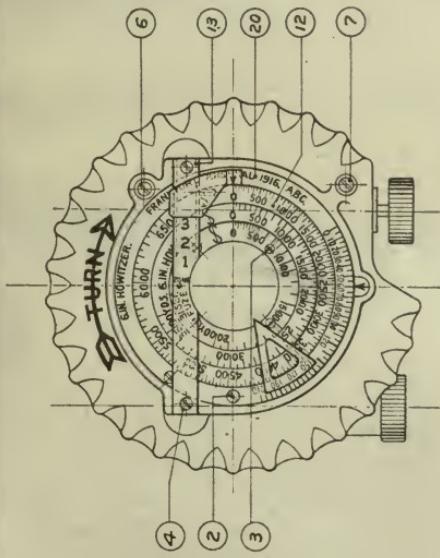
5. The worms (16) for the range and correction scales are mounted eccentrically in the worm cases (11), which upon rotation provide



SECTION-AA



SECTION-BB



an adjustment to accommodate for slight variations in manufacture and to take up for wear between the teeth of the worms and worm gears.

6. The worm-adjusting screw (24) provided for each worm (16) has a fiber washer (25) fitted in the end which bears on the flange of the worm to take up the end motion and to cause sufficient friction to resist accidental turning.

7. Clamp plugs (14 and 15) are provided for locking the adjusting screws and worm cases, these plugs being held in place by screws (6 and 7).

8. The index bar (13), which is attached to the case by two index bar screws (4), carries a range index (26) which slides on the bar and registers the desired zone. The range index is held in position by the index plunger (27) being forced into the notches of the index bar by the index spring (28).

9. The range ring (12) has three scales for zones 1, 2, and 3. The scale for each is graduated from 0 to the range corresponding to the maximum elevation. The least division is 50 yards. The corrector scale (20) has 42 divisions numbered each 2 divisions to 100, then 120, 150, 170, 190, and 210, graduation marked 60 being the normal position for a suitable height of burst. The corrector scale is used to vary the height of burst of shrapnel and to compensate for errors made in determining the angle of site and variations in the rate of burning of the time train of the fuze.

OPERATION.

First. Set the range index on the index bar to indicate the zone corresponding to the powder charge used.

Second. Turn the knob of the range worm until the required range on range ring registers with the index.

Third. Turn the knob of the corrector worm until the graduated line on the corrector scale, which indicates the desired correction for height of burst, registers with the engraved arrow on the case.

It should be remembered that 60 is the normal position and an increased reading increases the height of burst or shortens the range to point of burst; a decreased reading on the scales decreases the height of burst or increases the range to point of burst.

To set a fuse, first remove the waterproof cap, withdraw the safety wire, place the hand-fuse setter over the fuse and turn until the slot in the range-ring carrier engages with the pin on the graduated time train ring of the fuze. The guide plate and the range-ring carrier will then bear firmly on the projectile. Then turn the fuze setter clockwise, as indicated by the arrow on the top of the case, until the stop pin attached to the corrector-scale support engages with the fixed stop pin on the fuze and further motion is prevented.

The pointer which is attached to the top of the corrector scale should register with the graduated line on the closing cap of the fuze to indicate when the stop pin (17) of the fuze setter and the fixed stop pin of the fuze are in contact. This pointer was added because the graduated time train ring of the fuze may have a tendency to stick or bind to such an extent as to lead the operator to believe that the stop pin of the fuze setter and the fixed stop pin of the fuze are in contact and thus give a false setting.

Cards for recording the results of tests of the fuze setters are furnished by the Ordnance Department, on which calculated problems are given for inspection, as indicated below.

Hand-fuze setter for 31-second combination fuze.

[Calculated fuze settings for 6-inch howitzer.]

Range ring.	Corrector scale.	Calculated settings.		
		Zone 1.	Zone 2.	Zone 3.
0	60	0	0	0
1,000	10	8.9	7.04	6.08
2,000	90	18.26	8.65	5.91
3,500	60	-----	23.5	13.56
5,500	60	-----	-----	23.47
6,500	60	-----	-----	31.18

To check the fuze setter, set the range ring and corrector scale to the readings given. Set the fuze with the fuze setter and compare the setting of the fuze with the result in the table. Use shrapnel and not a drill cartridge in making this test. When the range index registers with 0 on the range ring and the corrector scale is set at 60, the fuze will be set at 0 and will explode immediately on leaving the howitzer. When setting a fuze to explode on impact or for safe transportation, set the range index at S and the corrector scale at 60. Great care should be exercised in making this setting and to replace the safety wires before transporting.

DISASSEMBLING AND ASSEMBLING.

To disassemble remove the index bar (13), which is held in place by two index bar screws (4). Take out the four range-ring screws (3) and the two corrector-scale screws (2), then remove the range ring (12) and corrector scale (20). Remove the six guide-plate screws (9) and guide plate (21).

To remove the worm knobs (10) from the worms (16) drive out the taper pins. Loosen the two worm-adjusting clamp screws (7), which release the adjusting screw clamp plugs (14 and 18), then remove the two adjusting screws (24); the two worms (16) can then be removed by turning. The corrector scale support (22) and range ring carrier (23) can then be removed.

To remove the two worm cases (11) loosen the two worm-case clamp screws (6), which releases the clamp plugs (15 and 19) and allows withdrawal. Assemble in reverse order.

ADJUSTMENT.

Backlash or lost motion may appear between the collars of the worms (16) and the fiber washers (25), between the worm teeth of range-ring carrier (23) and the threads of the worm (16), and between the worm teeth of the corrector-scale support (22) and the threads of the worm (16).

To remove backlash that appears endwise, loosen the worm-adjusting-screw clamp screws (7), which releases the worm-adjusting-screw clamp plug (right) (14) or the worm-adjusting-screw clamp plug (left) (18); then turn the worm-adjusting screws (24) clockwise with a screw driver until end play is removed and there is sufficient friction to prevent accidental rotation of the worms (16). Should backlash appear between the worm teeth of the range-ring carrier (23) and the threads of the worm (16) or between the worm teeth of the corrector-scale support (22) and the threads of the worm (16), it can easily be removed by loosening the worm-case clamp screws (6), which release the worm-case clamp plug (right) (15) or the worm-case clamp plug (left) (19), and then turning the worm case (11) with a screw driver in which the worm (16) is eccentrically mounted in order to bring the worm (16) closer in contact with the worm teeth. The worm-adjusting-screw clamp plug (right) (14), worm-case clamp plug (right) (15), worm-adjusting-screw clamp plug (left) (18), or worm-case clamp plug (left) (19) must be firmly clamped by tightening up on their respective screws after adjustment in order to secure the worm-adjusting screws (24) or worm cases (11) against rotation.

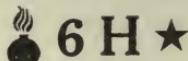
Nomenclature.

Illustration No.	Piece mark.	Name of piece.	Illustration No.	Piece mark.	Name of piece.
1	55A	Case.	15	54F	Worm-case clamp plug (right).
2	55C	Corrector-scale screw.	16	54G	Worm.
3	55C	Range-ring screw.	17	54H	Stop pin.
4	55D	Index-bar screw.	18	54J	Worm-adjusting-screw clamp plug (left).
5	55E	Oil-hole screw.	19	54K	Worm-case clamp plug (left).
6	55F	Worm-case clamp screw.	20	54EA	Corrector scale.
7	55F	Worm-adjusting-screw clamp screw.	21	54LA	Guide plate.
8	55G	Stop-pin screw.	22	54N	Corrector-scale support.
9	55H	Guide-plate screw.	23	54P	Range-ring carrier.
10	54A	Worm knob.	24	58N	Worm-adjusting screw.
11	54B	Worm case.	25	58P	Washer.
12	54V	Range ring.	26	59C	Range index.
13	54D	Index bar.	27	59D	Index plunger.
14	54E	Worm-adjusting-screw clamp plug (right).	28	59F	Index spring.

The nomenclature given above should be used when ordering spare parts.

MARKING ON AMMUNITION PACKING BOXES.

Both ends and sides of the box are marked with conspicuous characters to facilitate the rapid identification of the ammunition contained therein. The conspicuous marking consists of the following symbols:



The flaming bomb is always in red for mobile artillery ammunition. The numeral "6" refers to the caliber, and the letter "H" differentiates ammunition for guns and howitzers. The numeral "6" and the letter "H" are in red for high-explosive shrapnel and in black for common steel shell.

The star when present in the conspicuous marking indicates that the projectiles are provided with tracers. A red star indicates a night tracer and a black star a day tracer.

In addition to the conspicuous marking, the quantity and type of ammunition are indicated without symbols by the marking: "4 fixed common shrapnel," etc., so that in case one is not familiar with the conspicuous marking system he can immediately ascertain the key by this additional marking. Similarly, the word "Tracer" is added in amplification of the star symbol.

Also on both ends of the box the "Lot" followed by a number appears. This refers to the ammunition lot, and in case of any trouble arising with regard to the functioning of the ammunition, this lot number should be quoted in the report.

On the sides of the box similar markings are found accompanied by a pictorial stenciled symbol indicating the type of projectile, the tracers, and the fact that the ammunition is fixed.

For blank ammunition when packed assembled, the numeral "6" and the letter "H" are in blue.

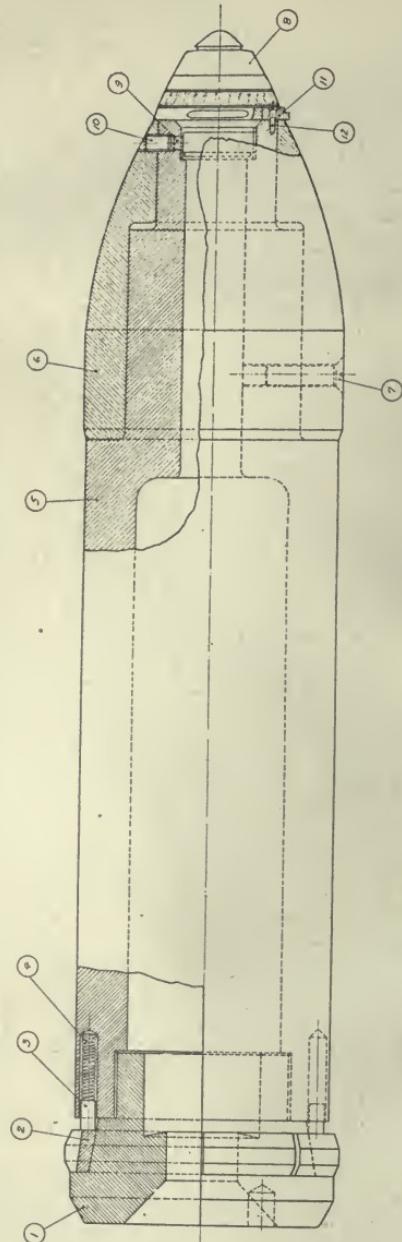
SUBCALIBER GUN.

A 1.457-inch subcaliber gun is being developed for this howitzer. The projectile is to contain a bursting charge and fuze, so that the points of impact may be readily observed. The projectile weighs 1.7 pounds and contains a smoke-producing compound.

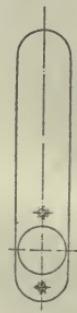
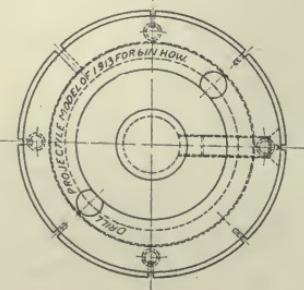
MISFIRES AND HANGFIRES.

Misfires and hangfires are of rare occurrence. In case of the failure of a cartridge to fire when the trigger is pulled, the pull should be repeated without opening the breech. The breechblock *should not be opened* until after the expiration of at least one minute from the time that the trigger is last pulled.

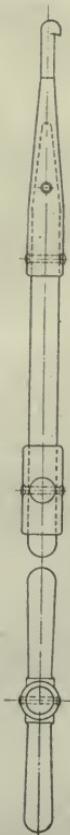
Plate V



SHELL PROJECTILE MODEL OF 1913.



CLOSING CAP WRENCH (2)



HAND EXTRACTOR (4)

Lack of complete rotation of the breechblock is the most usual cause of misfires, although occasionally due to defective primers or to a weakened firing spring.

DRILL PROJECTILE, MODEL OF 1913.

(Plate V.)

The drill projectile is a dummy projectile of the size and approximate weight of the service ammunition, and is used for drilling cannoneers in the use of the howitzer. It consists principally of the base (1), band (2), body (5), head (6), and a service 31-second combination fuse (8).

The band (2) is seated on the beveled surface of the base (1) and held in position by four plungers (3) and four springs (4). The base (1) is screwed into its threaded seat afforded in the rear end of the body (5). The interior surface of the base (1) is so shaped that the hook of the hand extractor (14) can be brought into use for extracting the drill projectile from the howitzer when drilling cannoneers.

The head (6) is seated upon the front end of the projectile and secured to the body (5) by a 0.5 by 1.75 standard countersunk head bronze screw (7). The service 31-second combination fuze (8), which contains no time trains, percussion and concussion elements, is screwed into the front end of the body (5) and secured in place by a 0.28 by 0.25 bronze shoe (9) and 0.375 by 0.56 headless steel screw (10). The fixed stop pin (11), of a special design, used in the fuse body instead of the present fixed stop pin on the service fuze, is secured to the body (5) by a 0.099 by 0.437 standard filister head steel screw (12).

The closing cap wrench (13) is provided for assembling and disassembling the closing cap from the point of the fuze.

The following spare parts are issued to each battery: 8 fixed stop pins with screws, 8 rotating pins with pins and 1 graduated time train ring.

The hand extractor (14) and closing cap wrench (13) are issued as tools and accessories.

Nomenclature.

Illustration No.	Piece mark.	Name of piece.	Illustration No.	Piece mark.	Name of piece.
1	1D	Base.	8	.....	31-second combination fuze.
2	1A	Band.	9	.....	0.28 by 0.25 bronze shoe.
3	5F	Plunger.	10	.....	0.375 by 0.56 headless steel screw.
4	5G	Spring.	11	5D	Fixed stop pin.
5	1H	Body.	12	.....	0.099 by 0.437 standard filister head steel screw.
6	1B	Head.	13	5E	Closing cap wrench.
7	.....	0.5 by 1.75 standard countersunk head bronze screw.	14	5A	Hand extractor.

The nomenclature given above should be used when ordering spare parts.

6-inch howitzer, range table.

SHELL AND SHRAPNEL.

[Zone 3, M. V. 900 feet per second.]

1	2	Angle of elevation.	$\Delta \times \text{for } \pm \Delta' \text{ elevation.}$	3	$\Delta \times \text{for } \pm \Delta' \text{ elevation.}$	4	$\Delta \times \text{for } \pm \Delta 10 \text{ F.S.M.V.}$	5	$\Delta \times \text{for wind 10 M.P.H.}$	6	$\Delta \times \text{for change of } \pm \frac{1}{10} \text{ C.}$	7	Time of flight.	8	Fuze setting.	9	Drift.	10	Deflection for 10 miles cross wind.	11	Angle of departure.	12	Slope of fall.	13	Terminal velocity.	14	Maximum ordinate.	15	Values of "C,"	16	Values of $\frac{Bc}{fa}$
Yds.	°	'	Yds.	Yds.	Yds.	Yds.	Yds.	Secs.	Divs.	Mils.	Mils.	°	'	I on—	F. s.	Ft.															
100	1	13	4.8	1.9	0.1	0.4	0.33	0.3	0.34	0.02	22	171.9	896	3	3.32	1,004															
200	1	34	4.8	3.8	.2	.8	.66	.6	.67	.04	43	85.9	891	6	3.31	1,008															
300	1	55	4.8	5.7	.3	1.2	.99	.9	1.00	.07	1	4	56.4	887	9	3.29	1,012														
400	2	16	4.7	7.6	.4	1.6	1.32	1.2	1.33	.09	1	25	41.9	883	13	3.28	1,016														
500	2	37	4.7	9.5	.5	2.1	1.66	1.6	1.66	.11	1	46	33.4	879	17	3.27	1,020														
600	2	58	4.7	11.5	.6	2.6	2.00	2.0	1.99	.13	2	7	27.5	874	21	3.26	1,023														
700	3	19	4.6	13.4	.8	3.2	2.34	2.4	2.32	.16	2	28	23.4	870	26	3.25	1,026														
800	3	41	4.6	15.3	1.0	3.8	2.68	2.8	2.66	.18	2	50	20.3	866	32	3.24	1,029														
900	4	3	4.6	17.2	1.2	4.4	3.02	3.2	3.00	.20	3	32	17.9	862	39	3.23	1,032														
1,000	4	25	4.5	19.1	1.4	5.0	3.37	3.6	3.34	.22	3	34	16.0	857	47	3.22	1,035														
1,100	4	47	4.5	21.0	1.6	5.6	3.72	4.0	3.68	.25	3	56	14.4	853	56	3.21	1,038														
1,200	5	9	4.5	22.9	1.8	6.2	4.07	4.4	4.03	.28	4	18	13.1	849	66	3.20	1,040														
1,300	5	31	4.4	24.8	2.0	6.9	4.43	4.8	4.38	.31	4	40	12.0	845	78	3.20	1,042														
1,400	5	54	4.4	26.7	2.3	7.6	4.79	5.2	4.73	.33	5	3	11.1	841	91	3.20	1,043														
1,500	6	17	4.4	28.6	2.6	8.4	5.15	5.6	5.09	.35	5	26	10.2	837	105	3.19	1,044														
1,600	6	40	4.3	30.6	2.9	9.3	5.52	5.9	5.45	.38	5	49	9.5	833	120	3.19	1,045														
1,700	7	3	4.3	32.5	3.2	10.2	5.88	6.3	5.81	.41	6	12	8.9	829	137	3.19	1,046														
1,800	7	26	4.3	34.4	3.6	11.1	6.26	6.7	6.18	.44	6	35	8.3	825	155	3.19	1,046														
1,900	7	50	4.2	36.3	4.0	12.1	6.63	7.1	6.55	.46	6	59	7.8	821	174	3.19	1,046														
2,000	8	14	4.2	38.2	4.4	13.1	7.01	7.4	6.92	.49	7	23	7.4	817	194	3.19	1,046														
2,100	8	38	4.1	40.1	4.9	14.1	7.34	7.8	7.30	.52	7	47	6.9	814	215	3.19	1,045														
2,200	9	2	4.1	42.0	5.5	15.2	7.77	8.2	7.68	.55	8	11	6.6	811	236	3.19	1,044														
2,300	9	27	4.0	43.9	6.1	16.3	8.16	8.6	8.06	.58	8	36	6.2	808	262	3.20	1,042														
2,400	9	52	4.0	45.8	6.7	17.5	8.55	9.0	8.45	.61	9	1	5.9	804	287	3.20	1,040														
2,500	10	17	4.0	47.7	7.4	18.7	8.94	9.4	8.84	.64	9	26	5.6	801	313	3.21	1,038														
2,600	10	42	3.9	49.5	8.1	20.0	9.34	9.8	9.24	.67	9	51	5.4	798	341	3.22	1,035														
2,700	11	8	3.9	51.4	8.8	21.3	9.74	10.2	9.64	.70	10	17	5.1	795	371	3.23	1,032														
2,800	11	34	3.8	53.2	9.5	22.7	10.14	10.6	10.05	.74	10	43	4.9	792	403	3.24	1,029														
2,900	12	0	3.8	55.0	10.2	24.1	10.54	11.0	10.46	.77	11	9	4.7	789	437	3.25	1,026														
3,000	12	26	3.8	56.8	11.0	25.6	10.95	11.4	10.87	.80	11	35	4.5	786	473	3.26	1,023														
3,100	12	53	3.7	58.7	11.9	27.1	11.36	11.8	11.29	.83	12	2	4.3	783	510	3.27	1,019														
3,200	13	20	3.7	60.4	12.8	28.7	11.77	12.3	11.71	.86	12	29	4.1	781	549	3.28	1,015														
3,300	13	47	3.6	62.2	13.8	30.3	12.19	12.7	12.12	.90	12	56	3.9	779	590	3.29	1,011														
3,400	14	15	3.6	63.9	14.8	31.9	12.61	13.1	12.56	.94	13	24	3.8	777	633	3.30	1,007														
3,500	14	43	3.5	65.6	15.8	33.5	13.03	13.6	12.99	.98	13	52	3.6	774	678	3.32	1,002														
3,600	15	11	3.5	67.3	16.8	35.2	13.46	14.0	13.43	1.01	14	20	3.5	772	725	3.34	997														
3,700	15	40	3.4	69.0	17.8	36.9	13.88	14.4	13.87	1.04	14	49	3.4	770	774	3.36	992														
3,800	16	9	3.4	70.6	18.9	38.6	14.32	14.9	14.32	1.08	15	18	3.3	768	825	3.38	987														
3,900	16	38	3.4	72.2	20.0	40.3	14.75	15.3	14.78	1.12	15	47	3.1	766	879	3.40	982														
4,000	17	8	3.3	73.8	21.1	42.1	15.19	15.8	15.25	1.15	16	17	3.0	764	935	3.41	977														
4,100	17	38	3.3	75.5	22.3	43.9	15.64	16.2	15.73	1.19	16	47	2.9	762	993	3.43	972														
4,200	18	9	3.2	77.0	23.5	45.8	16.09	16.7	16.22	1.23	17	18	2.8	760	1,053	3.45	967														
4,300	18	40	3.2	78.6	24.7	47.7	16.54	17.1	16.72	1.27	17	49	2.7	759	1,115	3.47	962														
4,400	19	12	3.1	80.1	26.0	49.7	17.00	17.6	17.23	1.31	18	21	2.7	758	1,179	3.48	957														
4,500	19	44	3.1	81.7	27.3	51.7	17.46	18.0	17.75	1.35	18	53	2.6	757	1,245	3.50	952														
4,600	20	17	3.0	83.3	28.6	53.8	17.93	18.5	18.28	1.39	19	26	2.5	755	1,313	3.52	947														
4,700	20	50	3.0	84.9	30.0	55.9	18.41	19.0	18.82	1.44	19	59	2.4	754	1,383	3.54	941														
4,800	21	24	2.9	86.4	31.4	58.1	18.90	19.6	19.36	1.49	20	33	2.3	753	1,455	3.57	935														
4,900	21	59	2.8	88.0	33.0	60.3	19.40	20.1	19.91	1.54	21	49	2.2	752	1,530	3.59	929														
5,000	22	35	2.7	89.5	34.6	62.6	19.91	20.6	20.47	1.59	21	44	2.2	751	1,608	3.61	923														
5,100	23	12	2.7	91.0	36.3	64.9	20.42	21.1	21.04	1.64	22	21	2.1	750	1,689	3.63	917														
5,200	23	50	2.6	91.6	38.2	67.3	20.94	21.7	21.62	1.69	22	59	2.1	749	1,773	3.65	911														
5,300	24	29	2.5	94.1	40.0	69.7	21.47	22.3	22.21	1.74	23	38	2.0	748	1,861	3.68	906														
5,400	25	9	2.5	95.6	42.0	72.2	22.01	22.9	22.82	1.79	24	25	1.9	747	1																

6-inch howitzer, range table—Continued.

SHELL AND SHRAPNEL—Continued.

[Zone 2, M. V. 629 feet per second.]

1 Yds.	Range. °	Angle of eleva- tion. °	2 △ X for ± Δ 1' elevation.	3 △ X for ± Δ 10 F. S. M. V.	4 △ X for wind 10 M. P. H.	5 △ X for change of ± 1/10 C.	6 Time of flight.	7 Fuze setting.	8 Drift.	9 Deflection for 10 miles cross wind.	10 °	11 Angle of depart- ture.	12 Slope of fall.	13 Terminal velocity.	14 Maximum ordi- nate.	15 Values of "C,"	16 Values of $\frac{B}{f_a}$
100	1 26	2.4	3.2	0.3	0.1	0.49	0.4	0.65	0.06	41	76.4	626	3	3.31	1.008		
200	2 9	2.3	6.4	.6	.3	.98	.8	1.32	.10	1 24	37.8	623	6	3.28	1.016		
300	2 52	2.3	9.6	.9	.5	1.47	1.1	1.99	.14	2 7	25.3	620	11	3.26	1.023		
400	3 35	2.3	12.8	1.2	.7	1.96	1.5	2.66	.19	92 50	18.9	618	18	3.24	1.029		
500	4 18	2.3	15.9	1.5	1.0	2.45	1.9	3.24	.24	3 33	15.0	616	27	3.22	1.034		
600	5 2	2.3	19.0	1.8	1.3	2.94	2.4	4.02	.29	4 17	12.4	613	38	3.21	1.038		
700	5 46	2.2	22.1	2.1	1.6	3.44	3.0	4.71	.34	5 1	10.6	610	51	3.20	1.040		
800	6 31	2.2	25.2	2.4	2.0	3.9	3.5	5.41	.39	5 46	9.2	608	66	3.20	1.042		
900	7 16	2.2	28.3	2.7	2.4	4.45	4.0	6.12	.44	6 31	8.2	605	83	3.20	1.043		
1,000	8 2	2.2	31.4	3.0	2.9	4.96	4.5	6.84	.49	7 17	7.3	603	102	3.20	1.043		
1,100	8 48	2.2	34.5	3.3	3.5	5.48	5.1	7.57	.54	8 3	6.6	601	123	3 20	1.042		
1,200	9 35	2.1	37.6	3.6	4.1	6.00	5.6	8.31	.59	8 50	6.0	598	146	3 20	1.040		
1,300	10 22	2.1	40.7	3.9	4.8	6.52	6.2	9.06	.64	9 37	5.5	596	172	3 21	1.036		
1,400	11 10	2.1	43.8	4.2	5.5	7.05	6.7	9.82	.70	10 25	5.1	593	200	3 23	1.031		
1,500	11 59	2.0	46.9	4.5	6.3	7.58	7.3	10.59	.76	11 14	4.8	591	231	3 25	1.025		
1,600	12 49	2.0	50.0	4.8	7.1	8.11	7.9	11.37	.82	12 4	4.4	589	265	3 27	1.018		
1,700	13 40	2.0	53.1	5.2	8.0	8.65	8.4	12.16	.88	12 55	4.1	586	301	3 30	1.010		
1,800	14 32	1.9	56.2	5.6	8.9	9.20	9.0	12.96	.94	13 47	3.9	584	340	3 33	1.002		
1,900	15 25	1.9	59.3	6.0	9.9	9.75	9.6	13.78	1.00	14 40	3.6	582	382	3 36	.993		
2,000	16 19	1.9	62.4	6.4	10.9	10.31	10.1	14.62	1.06	15 34	3.4	580	427	3 39	.984		
2,100	17 14	1.8	65.5	6.9	11.9	10.88	10.8	15.48	1.12	16 29	3.2	578	475	3 42	.975		
2,200	18 10	1.8	68.6	7.4	12.9	11.46	11.5	16.36	1.19	17 25	3.1	577	526	3 45	.965		
2,300	19 7	1.7	71.7	7.9	14.0	12.05	12.2	17.26	1.26	18 22	2.9	575	580	3 49	.955		
2,400	20 6	1.7	74.8	8.5	15.1	12.66	12.9	18.18	1.33	19 21	2.7	574	638	3 53	.945		
2,500	21 7	1.6	77.9	9.1	16.2	13.27	13.6	19.13	1.41	20 22	2.6	572	700	3 57	.935		
2,600	22 10	1.6	81.0	9.7	17.4	13.90	14.5	20.11	1.49	21 25	2.5	571	767	3 60	.925		
2,700	23 15	1.5	84.0	10.3	18.6	14.56	15.4	21.13	1.57	22 30	2.4	569	839	3 64	.916		
2,800	24 23	1.4	86.9	11.1	19.9	15.23	16.9	22.19	1.66	23 38	2.2	567	916	3 68	.907		
2,900	25 34	1.4	89.8	12.1	21.2	15.93	17.2	23.30	1.75	24 49	2.1	566	999	3 71	.899		
3,000	26 49	1.3	92.5	13.3	22.6	16.67	18.0	24.47	1.85	26 4	2.0	564	1,089	3.74	.892		
3,100	28 9	1.2	95.1	14.8	24.1	17.4	19.1	25.72	1.96	27 24	1.9	563	1,189	3.76	.887		
3,200	29 36	1.1	97.6	16.6	25.7	18.28	20.2	27.08	2.09	28 51	1.8	561	1,305	3.77	.885		
3,300	31 13	1.0	100.0	18.9	27.4	19.21	21.3	28.60	2.24	30 28	1.6	560	1,445	3.75	.888		
3,400	33 6	.8	102.3	22.1	29.2	20.26	22.4	30.37	2.41	32 21	1.5	559	1,619	3.71	.898		
3,500	35 26	.6	104.5	26.8	31.1	21.51	23.5	32.56	2.63	34 41	1.4	558	1,839	3.63	.917		
3,600	38 32	.4	106.6	33.7	33.2	23.22	24.6	35.50	3.00	37 47	1.2	557	2,129	3.50	.952		
3,633	40 0	.3	107.4	36.8	33.9	24.50	25.0	36.90	3.30	39 15	1.1	556	2,310	3.44	.970		

[Zone 1, M. V. 464 feet per second.]

100	2 0	1.3	4.6	.1	.1	.66	.5	1.26	.09	1 20	45.2	462	11	3 28	1.015
200	3 18	1.3	9.2	.2	.2	1.32	1.0	2.48	.17	2 38	22.6	461	23	3.25	1.028
300	4 37	1.3	13.7	.3	.3	1.98	1.5	3.71	.23	3 57	14.7	459	37	3.22	1.037
400	5 57	1.3	18.1	.4	.5	2.64	2.0	4.96	.35	5 17	10.9	458	53	3.20	1.043
500	7 18	1.2	22.5	.5	.7	3.30	2.5	6.23	.44	6 38	8.6	456	71	3.19	1.046
600	8 40	1.2	26.9	.6	1.0	3.96	3.3	7.52	.53	8 0	7.1	455	91	3.19	1.044
700	10 4	1.2	31.3	.7	1.3	4.63	4.0	8.83	.62	9 24	6.0	453	113	3.21	1.038
800	11 30	1.1	35.7	.9	1.6	5.32	4.8	10.17	.71	10 50	5.2	452	138	3.24	1.028
900	12 58	1.1	40.0	1.1	1.9	6.03	5.6	11.54	.81	12 18	4.5	450	167	3.28	1.016
1,000	14 28	1.1	44.2	1.4	2.3	6.76	6.4	12.95	.91	13 48	4.0	448	200	3.33	1.002
1,100	16 1	1.0	48.3	1.8	2.7	7.51	7.5	14.40	1.02	15 21	3.6	447	238	3.38	.987
1,200	17 37	1.0	52.4	2.3	3.2	8.29	8.5	15.90	1.14	16 57	3.2	445	282	3.43	.971
1,300	19 16	1.0	56.5	2.9	3.8	9.10	9.6	17.45	1.27	18 36	2.9	444	333	3.49	.954
1,400	20 59	.9	60.5	3.7	4.5	9.94	10.7	19.07	1.41	20 19	2.6	442	392	3.56	.936
1,500	22 48	.9	64.5	4.7	5.4	10.81	11.8	20.79	1.56	22 6	2.4	440	460	3.63	.919
1,600	21 46	.8	68.4	5.9	6.5	11.72	13.4	22.65	1.72	24 6	2.1	439	540	3.69	.903
1,700	26 57	.7	72.2	7.4	7.8	12.70	15.0	24.70	1.90	26 17	1.9	437	637	3.74	.889
1,800	29 27	.6	76.0	9.2	9.3	13.77	16.6	27.03	2.11	28 47	1.7	436	756	3.76	.885
1,900	32 26	.5	79.7	11.6	11.1	14.99	18.2	29.81	2.37	31 46	1.5	434	905	3.72	.895
2,000	36 11	.3	83.4	14.9	13.2	16.48	19.8	33.35	2.72	35 31	1.3	433	1,100	3.60	.925
2,068	40 0	.2	85.7	17.8	14.7	18.25	20.7	36.97	3.22	39 20	1.1	433	1,300	3.43	.972

ALLOWANCE OF AMMUNITION.

Shell and shrapnel ammunition is issued by the Ordnance Department in moisture-proof, zinc-lined wooden packing boxes, one round per box.

The annual allowance of ammunition for the instruction of Field Artillery is prescribed from time to time in War Department orders.

BLANK AMMUNITION.

Blank metallic ammunition consists of the following components: A brass cartridge case, a percussion primer, a charge of black powder in a cloth bag, and a tight-fitting felt wad.

The powder charge is contained in a silk cartridge cloth bag; this is to prevent any powder from leaking out in event of the dislodgement of the wad, due to rough handling in transportation or jolting in caissons and limbers.

THE CARTRIDGE CASE.

The cartridge case for blank ammunition is identical with the service cartridge case.

Cartridge cases that have become deformed in service should be turned in to the posts or arsenals designated in current orders for resizing and re-forming.

THE PRIMER.

The saluting primer (percussion) is used in the preparation of blank metallic ammunition for the 6-inch howitzer. The primer should be a tight fit in the primer seat in the cartridge case, and must be pressed into place with the primer-inserting press provided for the purpose, and not hammered in. No primer should be used that is not a tight fit in its seat in the case.

Cartridge cases should be primed just before the insertion of the powder charge, and under no circumstances will primers be inserted after the powder charge has been inserted.

Primers are issued in hermetically sealed tin boxes, which should not be broken open until the primers are to be used, as they deteriorate when exposed to atmospheric influences.

THE CHARGE.

The charge to be used in the preparation of blank metallic ammunition for the 6-inch howitzer is 2 pounds.

PREPARATION OF BLANK METALLIC AMMUNITION.

Blank metallic ammunition will be assembled at posts or in the field under the personal supervision of a commissioned officer, who will be held responsible that it is prepared in the manner prescribed in the annual target-practice orders.

For this purpose there are issued cartridge cases, saluting powder in bulk, cartridge cloth bags, twine, tight-fitting felt wads, rubberine or other quick-drying paint, primers, and reloading and cleaning outfits.

When saluting powder is issued in bulk for use in blank ammunition the bags and twine should be requisitioned for separately and should be invoiced separately.

Before assembling, the cartridge cases should be carefully inspected to see that they are in sound condition and thoroughly clean and dry. They should also be tested by trying them in the gun, to determine whether they have become deformed. Any cases that do not readily enter the chamber in the gun or that are otherwise seriously deformed should be laid aside for resizing. After inspecting the cartridge cases the blank ammunition should be prepared as follows:

- (a) Insert the primers with the primer-inserting press.
- (b) Pour the proper weight of powder into the cloth bag and tie up the mouth of the bag with twine. Before inserting in the cartridge case, see that the opening in the bottom of the bag is free to allow it to settle around the primer. In tying the bag, use no more twine and leave no more cloth in the "choke" than necessary, and place the bag in the cartridge case with the choke end toward the mouth of the case.
- (c) Insert the felt wad and press it down hard until it rests squarely on the powder charge.
- (d) Give the upper surface of the felt wad and the inside of the cartridge case just above the wad a good coat of the rubberine or other quick-drying paint furnished for the purpose, using a brush, and allow the case to stand until this coat is dry. Then apply another coat of rubberine paint in a similar manner. The object of using rubberine paint, which is strongly adhesive, is to thoroughly seal the joint between the wad and the case to prevent any powder grains from leaking out, and at the same time to firmly hold the wad in place.

PRECAUTIONS TO BE OBSERVED.

Firings with blank metallic ammunition will be greatly facilitated by a careful observance of the following:

Before all firings a careful examination should be made of the assembled rounds to see that the felt wads have not become displaced or the cartridge cases dented or deformed by careless handling.

If the cartridge cases have been properly resized and are clean, no difficulty should be experienced in inserting them in the howitzer provided the chamber of the latter is clean. The continued insertion of cartridge cases that are not clean causes an accumulation in the powder chamber which may make the insertion of subsequent rounds difficult or impossible.

In firing blank ammunition the powder chamber will be sponged after each round with a damp sponge, to extinguish sparks and remove powder residue resulting from the previous round before the insertion of another round as prescribed in the annual target practice orders.

Care will be taken to see that the sponges are not worn and that they thoroughly fit the chamber. The interval between rounds in firing blank ammunition should be sufficient to allow thorough sponging of the chamber and examination to ascertain that all sparks have been extinguished.

Wads for the preparation of blank metallic ammunition are made to tightly fit in the cartridge case. No wads should be used that are not a tight fit in the case.

CARE OF CARTRIDGE CASES.

As soon after firing as practicable the fired primers should be removed from the cartridge case by means of the decapping tool furnished with the reloading outfit. The case should be thoroughly washed in a strong solution of lye or soft soap to remove all powder residue. It should then be thoroughly dried.

If the cartridge cases are carefully cleaned and washed immediately after firing, not only will less labor be required but the life of the cases will be greatly prolonged.

A good solution for washing cartridge cases may be prepared by using ingredients in the following proportions:

- 1 gallon of water.
- $2\frac{1}{2}$ ounces soft soap.
- $5\frac{1}{2}$ ounces soda.

The mixture should be boiled and stirred until the ingredients are entirely dissolved.

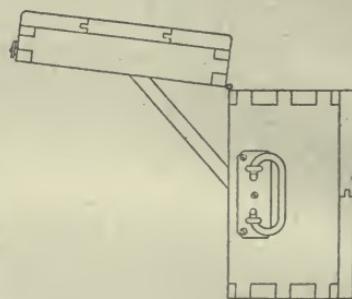
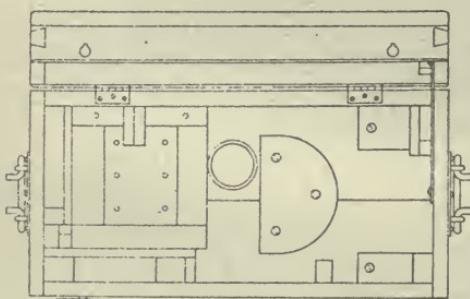
In washing cartridge cases this solution should be used hot and in sufficient quantity to completely immerse the cases.

Primers that misfire should be turned in with the cases to the ordnance establishment prescribed in the target-practice order.

Resizing of cartridge cases.—The resizing of 6-inch howitzer cartridge cases that have become deformed in service is done at Frankford Arsenal, Philadelphia, Pa.



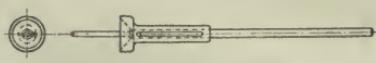
RELOADING AND CLEANING OUTFIT FOR
6 INCH HOWITZER, MODEL OF 1908



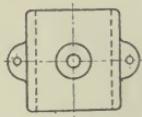
STORAGE CHEST.



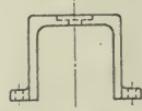
CLEANING BRUSH.



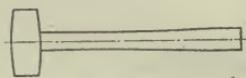
DECAPPING TOOL.



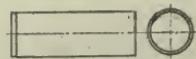
CASE HOLDER.



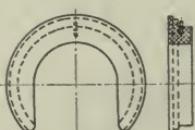
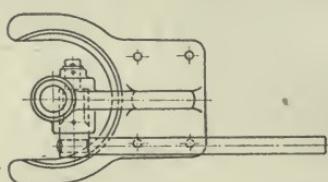
CASE HOLDER STAND.



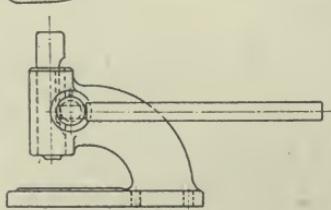
HAMMER.



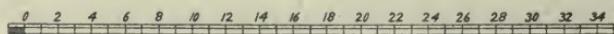
SALUTING
POWDER MEASURE.



BUSHING.



LARGE
PRIMER INSERTING PRESS.



CL 56-DN 25-DR. I

THE RELOADING AND CLEANING OUTFIT.

(Plate VI.)

This outfit consists of the following parts and is furnished to each post where a saluting gun or battery is kept:

Large primer-inserting press.	Class V, Section 5.
Bushing.	
Saluting powder measure.	
Decapping tool with guide.	
Cleaning brush.	
Hammer, bronze.	
Case holder.	
Case-holder stand.	

The primer-inserting presses are standard for all guns using metal cartridge cases, there being two sizes, one size for cartridge cases for 1-pounder to 3-inch guns, inclusive, and one size for 3-inch guns, model of 1903, to 6-inch guns, inclusive. The bushings are furnished to suit the size of cartridge case that is to be reprimed, one bushing for each different size of case.

The case-holder stand is the same for all cases. The case holder varies with the size of case.

The decapping tool and case holder are used for removing fired primers. The decapping tool varies in length with the size of the cartridge case to be decapped. A light blow on the rod with a piece of wood or the bronze hammer generally removes the primer.

A powder measure to suit the saluting charge for each caliber of gun is furnished, and when level full holds the required charge. Each powder measure is plainly marked on the base for the caliber of gun for which it is intended.

The cleaning brush is furnished for cleaning the cartridge cases after they have been used and should be ordered to suit the size of case for which intended.

The parts constituting the reloading and cleaning outfit for the 6-inch howitzer are shown on Plate VI.

THE 6-INCH HOWITZER CARRIAGE, MODEL OF 1908.

(Class IV, Section 3.)

WEIGHTS, PRINCIPAL DIMENSIONS, ETC.

Weight of carriage, complete.....	pounds..	5,443
Weight of howitzer and carriage, complete.....	do....	7,354
Weight at lunette, carriage limbered and in battery.....	do....	455
Weight at lunette, carriage limbered and howitzer in traveling position..	do....	1,193
Diameter of wheels.....	inches..	60
Width of track.....	do....	60
Maximum angle of elevation.....	degrees..	40
Maximum angle of depression.....	do....	5

Amount of traverse of howitzer on carriage.....	millièmes..	107
Length of recoil of howitzer on carriage, howitzer at zero degrees elevation.....	inches..	63
Length of recoil of howitzer on carriage, howitzer at 40 degrees elevation.. do....	do....	26
Height of axis of howitzer.....	do....	43
Height of line of peep sight.....	do....	51
Length of sight radius.....	do....	19

Nomenclature of parts of carriage.

Number.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
2	Apron latches, complete, including:			
2	Apron-latch bodies.....	On apron latch bases.....		
2	Apron-latch handles.....			
2	Apron-latch springs.....			
2	Apron-latch plungers.....			
2	Apron-latch washers.....			
1	Brake mechanism, consisting of:			
1	Bell crank, left.....	Pinned to bell-crank bracket.....		
1	Bell crank, right.....	.....do.....		
2	Bell crank bearing bolts.....	Bolt bell cranks to bell-crank brackets.....		
3	Bell-crank bolts.....	Through bell cranks and connecting rod.....		
1	Brake-beam body, left.....	Hinged to brake-beam bracket.....		
1	Brake-beam body, right.....	.....do.....		
4	Brake-beam hinges.....	Riveted to brake-beam bodies.....		
2	Brake-beam stiffeners.....	.....do.....		
1	Brake-eccentric strap.....	On brake-lever hub.....		
1	Brake lever.....	Riveted to brake lever.....		
1	Brake-lever catch.....	.....do.....		
1	Brake-lever hook.....	In brake-lever hub.....		
1	Brake-lever pin.....	Connects left brake beam and brake-rod end.....		
1	Brake rod, left.....	Connects right bell crank and brake-rod end.....		
1	Brake rod, right.....	Riveted to brake-beam body.....		
1	Brake-rod bracket, left.....	.....do.....		
1	Brake-rod bracket, right.....	Connect left brake rod and left bell crank.....		
2	Brake-rod ends.....	Connect right brake rod and brake-eccentric strap.....		
1	Brake-rod pin.....	Through right brake-rod end and brake-eccentric strap.....		
1	Brake segment.....	Riveted to right brake beam.....		
1	Brake-segment rack.....	Riveted to brake segment.....		
2	Brake shoes.....	Pinned to brake-shoe bearings.....		
2	Brake shoe bearings.....	Riveted to brake beam bodies.....		
2	Brake shoe pins.....	Pin brake shoes to brake shoe bearings.....		
1	Connecting rod.....	Connects bell cranks.....		
2	Cradle, complete, including—			
2	Bushings.....	Forced on trunnions.....		
1	Bushing.....	Riveted in cradle head (rear).....		
1	Cradle bottom plate.....	Forms bottom of cradle.....		
1	Cradle head.....	At front end of cradle.....		
1	Cradle head (rear).....	Riveted near rear end of cradle.....		
2	Cradle head side clips.....	Riveted on front end of cradle plate.....		
2	Cradle head top clips.....	.....do.....		
1	Cradle plate.....	Forms hood over recoiling parts.....		
2	Cradle plate angles.....	Reinforce rear end of cradle plate.....		
2	Gun slides.....	Riveted in cradle bottom plate.....		
1	Patent plate.....	Screwed on left side of cradle plate.....		
1	Pawl bearing, left.....	Riveted to cradle plate.....		
1	Pawl bearing, right.....	.....do.....		
2	Rack bolts.....	Fasten quick release rack to trunnion.....		
2	Rack studs.....	Screwed into right trunnion.....		
1	Shaft bearing (front).....	Supports intermediate shaft of valve turning gear.....		
1	Shaft bearing (rear).....	.....do.....		
1	Shoulder guard.....	Riveted to left side of cradle plate.....		
1	Spring retainer.....	At front end of cradle.....		
1	Spring retainer clip, left.....	Riveted on front end of cradle plate.....		
1	Spring retainer clip, right.....	.....do.....		
1	Spring stirrup guide, left.....	Riveted to cradle bottom plate.....		
1	Spring stirrup guide, right.....	.....do.....		
6	Swing bolts.....	In cradle head and spring retainer clips.....		
1	Trunnion, left.....	Riveted to cradle plate.....		
1	Trunnion, right.....	.....do.....		

Nomenclature of parts of carriage—Continued.

Number.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Elevating mechanism consisting of—			
1	Collar.....	On elevating shaft.....		
1	Elevating gear.....	On left end of elevating shaft.....		
1	Elevating handwheel consisting of—			
1	Counterbalance.....			
1	Handwheel body.....			
1	Hub.....			
1	Instruction plate.....	On handwheel shaft.....		
1	Reinforce piece.....			
1	Sleeve.....			
1	Spindle.....			
2	Elevating pinions.....	On elevating shaft.....		
1	Elevating shaft.....	In elevating bearings.....		
2	Elevating worm bevel gears.....	On front ends of worms.....		
1	Handwheel shaft.....	In bearings on left side of top carriage.....		
1	Handwheel shaft bevel pinion.....	On handwheel shaft.....		
1	Handwheel shaft collar.....	On forward end of handwheel shaft.....		
1	Right bearing bushing.....	In right elevating bearing.....		
1	Rocker (left).....	On trunnion.....		
1	Rocker (right).....	do.....		
1	Rocker brace.....	Connects rockers.....		
2	Rocker brace end pieces.....	In ends of rocker brace.....		
2	Washers.....	Riveted to rocker hubs.....		
2	Washers.....	On worms.....		
1	Washer.....	On elevating shaft.....		
2	Worms.....	In elevating worm bearings.....		
	Firing mechanism, complete, consisting of—			
1	Adjusting screw.....	In firing handle bracket.....		
2	Bracket studs.....	Secure firing handle bracket to cradle.....		
1	Check nut.....	On adjusting screw.....		
1	Firing handle.....	Assembled on firing handle hub.....		
1	Firing handle bracket.....	On rear end of cradle.....		
1	Firing handle hub.....	In firing handle bracket.....		
2	Firing links.....	Connect firing shaft and firing pallet.....		
2	Firing link pins.....	Through firing links.....		
1	Firing pallet.....	Assembled in lower bearing of bracket.....		
1	Firing pallet collar.....	On firing pallet.....		
1	Firing shaft.....	Assembled in upper bearing of bracket.....		
2	Handle return springs.....	Assembled in bracket.....		
1	Pallet collar pin.....	Secures firing pallet collar.....		
1	Shaft trip collar.....	On front end of firing shaft.....		
1	Trip collar pin.....	Secures shaft trip collar.....		
1	Trip lathe.....			
1	Trip-latch pin.....	Assembled in firing-handle hub.....		
1	Trip-latch plunger.....			
1	Trip-latch spring.....			
	Front traveling lock, complete, consisting of—			
1	Chain.....	Attached to front locking pin and chain rivet.....		
2	Chain rings.....	In front traveling lock.....		
1	Chain rivet.....	On chain.....		
1	Front locking pin.....	In front traveling-lock bearings.....		
1	Front traveling lock.....	Riveted to front locking pin.....		
1	Locking-pin spring.....	On axle.....		
1	Traveling-lock fastener.....			
2	Handspones, complete, consisting of—			
4	Handsponge bodies.....	On sides of handsponge webs.....		
1	Handsponge latch, left.....	Pinned to handsponge.....		
1	Handsponge latch, right.....	do.....		
2	Handsponge webs.....	Pinned to spade key brackets.....		
2	Lower bands.....	At lower end of handspones.....		
2	Middle bands.....	Around middle of handspones.....		
2	Tips.....	At upper ends of handspones.....		
	Quick-return mechanism, consisting of—			
1	Bearing retainer.....	In bearing case.....		
2	Bushings.....	In right and left pawls.....		
1	Bushing, lower.....	In lower end of shaft housing.....		
1	Bushing, upper.....	In upper end of shaft housing.....		
1	Clutch spring.....	On pinion shaft.....		
1	Gear.....	Bevel gear on lower end of intermediate shaft.....		
1	Gear cover.....	Screwed to inside of top carriage, right clip.....		
1	Handwheel shaft.....	In handwheel shaft bearing.....		
1	Handwheel shaft bearing.....	Assembled in top carriage, right clip.....		
1	Inner spring washer.....	On pinion shaft.....		

IV 3

Nomenclature of parts of carriage—Continued.

Number.	Name of part.	Location, etc.	Property classification.	
			Class.	Section
	Quick-return mechanism, consisting of—Continued.			
1	Intermediate gear.....	Bevel gear on pinion shaft.....		
1	Intermediate-gear sleeve.....	On pinion shaft.....		
1	Intermediate shaft.....	In shaft housing.....		
1	Key.....	In bearing retainer.....		
1	Outer spring washer.....	On pinion shaft.....		
1	Pawl, left.....	On pawl shaft.....		
1	Pawl, right.....	.....do.....		
1	Pawl hand e.....	Riveted to right pawl.....		
2	Pawl plungers.....	In pawls.....		
1	Pawl shaft.....	Conncts pawls through cradle		
2	Pawl springs.....	On plungers.....		
1	Pinion shaft.....	In pinion-shaft bearing.....		
1	Pinion-shaft bearing.....	In bearing case.....		
1	Pinion-shaft clutch.....	On pinion shaft.....		
1	Quick-return handwheel, consisting of—			
1	Counterbalance.....			
1	Handwheel body.....			
1	Hub.....	On handwheel shaft.....		
1	Reinforce pie e.....			
1	Sleeve.....			
1	Spindle.....			
1	Quick-return segment.....	Bolted to right trunnion.....		
4	Retainer b'nts.....	Secure bearing retainer.....		
1	Safety latch.....	Pinned to safety-latch bearing.....		
1	Safety-latch bearing.....	Riveted to right pawl bearing.....		
1	Safety-latch plunger.....	In safety-latch bearing.....		
1	Safety-latch spring.....	On safety-latch plunger.....		
1	Shaft housing.....	Between top carriage right clip and bearing case.....		
1	Washer.....	On pawl shaft.....		
1	Do.....	On safety-latch bearing.....		
	Rear traveling lock, complete, consisting of—			
2	Chains.....	Attached to rear locking pins and rear traveling lock.....		
4	Chain rings.....	In rear traveling lock.....		
2	Chain rivets.....	Secures traveling lock in position.....		
1	Rear locking pin, long.....	.....do.....		
1	Rear locking pin, short.....	In traveling-lock clips.....		
1	Rear traveling lock.....	In rear traveling lock.....		
2	Stop pins, with chains, rings, and rivets.....			
	Recoil and counterrecoil arrangement, consisting of—			
4	Inner counterrecoil springs.....	In spring stirrup on recoil cylinder.....		
3	Inner spring separators.....	Between sections of inner counterrecoil spring.....		
4	Outer counterrecoil springs.....	In cradle on spring stirrup.....		
3	Outer spring separators.....	Between sections of outer counterrecoil spring.....		
1	Spring follower.....	On recoil cylinder.....		
1	Spring stirrup.....	Inside outer counterrecoil spring.....		
1	Stirrup inner ring.....	Screwed into rear end of stirrup.....		
1	Stirrup outer ring.....	On front of spring stirrup.....		
1	Recoil cylinder, complete, includes—			
1	Counterrecoil buffer.....	Screwed into rear cylinder head.....		
1	Cylinder liner.....	Secured in cylinder.....		
1	Cylinder-liner lock.....	Screwed through liner and cylinder.....		
1	Cylinder-liner lock gasket.....	On cylinder-liner lock.....		
1	Cylinder-locking screw.....	Locks cylinder retaining ring on cylinder.....		
1	Cylinder-retaining ring.....	Connects cylinder to howitzer.....		
2	Filling and drain plugs.....	In front cylinder head.....		
1	Filling plug.....	In front end of recoil cylinder.....		
1	Filling-plug gasket.....	Under filling plug.....		
1	Front cylinder head.....	In recoil cylinder.....		
1	Gland lock.....	Secures piston-rod gland in adjustment.....		
3	Liner bolts.....	Bolt liner on piston.....		
1	Lock fulcrum.....	Screwed in front cylinder head.....		
1	Piston and piston rod.....	In recoil valve.....		
1	Piston liner.....	Bolted on piston.....		
1	Piston-rod gland.....	On front cylinder head.....		
1	Piston-rod plug.....	Screwed in piston rod.....		
1	Piston-rod washer.....	On front end of piston rod.....		
1	Rear cylinder head.....	Screwed into rear end of recoil cylinder.....		

IV 3

Nomenclature of parts of carriage—Continued.

Number.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Recoil and counter recoil arrangement, consisting of—Continued.			
	Recoil cylinder, complete, includes—Continued.			
1	Recoil cylinder.....	In cradle.....		
1	Recoil valve.....	Inside of cylinder liner.....		
4	Rings of Garlock hydraulic waterproof packing, 0.375 square.	In stuffing box of front cylinder head.....		
2	Screw plugs.....	In cylinder-retaining ring.....		
1	Valve retainer.....	On end of recoil valve.....		
1	Vent gasket.....	Under vent plug.....		
1	Vent plug.....	In rear end of recoil cylinder.....		
	Valve turning gear, consisting of—			
1	Collar.....	On intermediate shaft.....		
1	Gear retainer.....	Retains valve-gear sector to cradle head.....		
1	Gear-retainer nut.....	On gear retainer.....		
1	Intermediate shaft.....	In bearings in left side of cradle.....		
1	Shaft arm.....	On rear end of intermediate shaft.....		
1	Valve-gear sector.....	On cradle head.....		
1	Valve link.....	Connects shaft arm and trunnion cap.....		
2	Valve-link pins.....	Connect valve link and trunnion.....		
2	Valve-link trunnions.....	One in shaft arm; one in left trunnion cap of top carriage.....		
2	Valve-link trunnion nuts.....	On valve-link trunnions.....		
1	Valve-pinion sector.....	Attached to cradle head.....		
	Shields, consisting of—			
1	Apron shield, complete, including—			
1	Apron plate.....	Hinged to lower end of main shield.....		
2	Apron-latch staples.....	Riveted in apron plate.....		
3	Shield hinges, female.....	Riveted to apron plate.....		
1	Main shield, complete, including—			
1	Bracket base, left.....	Bolted to shield.....		
1	Bracket base, right.....	In top shield braces.....		
2	Chain rings.....	Bolted to main shield and axle arm.....		
1	Diagonal shield brace, left.....	Under hinges; sight port shutter.....		
1	Diagonal shield brace, right.....	On shield stiffeners.....		
2	Filers; shutter hinge.....	Riveted to shield.....		
4	Filler plates.....	...do.....		
2	Hinges; sight port shutter.....	Between top shield brackets.....		
1	Main shield plate.....	Riveted near bottom of main shield.....		
1	Safety-depression stop, left.....			
1	Safety-depression stop, right.....			
2	Separators.....			
2	Shield angles.....			
2	Shield braces, composed of—			
2	Lower clips.....	Brace main shield to axle arms.....		
2	Upper clips.....	Riveted to top of main shield.....		
2	Tubes.....	Riveted to bottom of main shield.....		
4	Shield hinges, female.....	Riveted to main shield.....		
3	Shield hinges, male.....	...do.....		
1	Shield stiffener, left.....	Riveted to main shield.....		
1	Shield stiffener, right.....	...do.....		
2	Top shield brace pins with chains, rings, and links.....	In top shield brackets.....		
1	Top shield bracket, long, left.....	Riveted to main shield.....		
1	Top shield bracket, long, right.....	...do.....		
1	Top shield bracket, short, left.....	...do.....		
1	Top shield bracket, short, right.....	...do.....		
1	Top shield, complete, including—			
4	Shield hinges, male.....	Riveted to top shield.....		
1	Top shield plate.....	Hinged to main shield.....		
1	Top shield brace, long.....	Finned to top shield fastening.....		
1	Top shield brace, short.....	...do.....		
2	Top shield fastenings.....	Riveted to top shield.....		
1	Panoramic sight case, consisting of—			
2	Bearing plates, lower.....	Below case supports.....		
2	Bearing plates, upper.....	Above case supports.....		
1	Bracket.....	Forms support for case springs.....		
1	Case back.....			
1	Case body.....			
2	Case hinges, lower half.....	Riveted to case body.....		
2	Case hinges, upper half.....	Riveted to lid.....		
2	Case supports.....	Riveted to sides of case.....		

IV 3

Nomenclature of parts of carriage—Continued.

Num- ber.	Name of part.	Location, etc.	Property classification.	
			Class.	Sec- tion.
	Shields, consisting of—Continued.			
	Panoramic sight case, consisting of—Continued.			
1	Chain, complete, with two rings, one bolt snap, and one padlock.	In chain rivet.....		
1	Chain rivet.....	In left side of bracket.....		
1	Hasp.....	Pinned to hasp hinge.....		
1	Hasp hinge.....	Riveted to lid.....		
1	Lid.....	Hinged to case body.....		
1	Lid stop.....	Riveted to case body.....		
8	Panoramic sight case springs	Inside of springs.....		
4	0.375 pipes.....	Riveted to bracket.....		
2	Spring supports.....	On wing nut pin.....		
1	Wing nut.....	Riveted to case body.....		
1	Wing nut pin.....	Inside of case opposite wing nut pin.....		
1	Wing nut pin, reinforce.....	On wing nut pin.....		
1	Wing nut pin washer.....			
	Panoramic sight case sight bracket, consisting of—			
1	Bracket spring.....	On sight bracket.....		
1	Bracket spring lug.....	Riveted to bracket spring.....		
1	Sight bracket.....	Riveted inside of case.....		
1	Wrench stud.....	In sight bracket.....		
	Shutter; peep sight, port, consisting of—			
1	Shutter.....	Hinged to shield.....		
1	Shutter support.....	Riveted to shutter.....		
2	Hinges; sight port shutter.....	do.....		
1	Shutter; panoramic sight port, consisting of—			
1	Shutter.....	Hinged to shield.....		
1	Shutter latch base.....	Riveted to shutter.....		
1	Shutter latch plunger.....	In shutter latch base.....		
1	Shutter latch spring.....	Around shutter latch plunger.....		
	Sighting arrangement, consisting of—			
1	Front sight, complete.....	On projection of sight fastening.....		
1	Panoramic sight.....	On sight shank.....		
1	Peep sight.....	Slides in sight shank.....		
1	Sight bar.....	Clamped on shaft of sight lever.....		
1	Sight lever.....	Mounted on sight fastening.....		
1	Sight link.....	Between sight lever and rocker.....		
1	Sight shank.....	In sight shank socket.....		
1	Sight shank socket.....	On rear end of sight bar.....		
1	Sight shank socket cover.....	On sight shank socket.....		
1	Sight wrench.....	In trail box.....		
1	Teat wrench for panoramic sight.....	do.....		
2	Spade, complete, consisting of—			
4	Chain eyes.....	Riveted in spade bearing.....		
4	Chain rings.....	On chains.....		
2	D-rings.....	In spade keys.....		
1	Float, left.....	Riveted to spade frame.....		
1	Float, right.....	do.....		
1	Float reinforce.....	Riveted to floats.....		
1	Spade bearing, left.....	Riveted to spade.....		
1	Spade bearing, right.....	do.....		
1	Spade brace, left.....	Inner side of spade framework.....		
1	Spade brace, right.....	do.....		
1	Spade edge.....	Forms point of spade.....		
1	Spade frame.....	Forms face of spade.....		
1	Spade frame brace, left.....	Riveted to spade frame.....		
1	Spade frame brace, right.....	do.....		
1	Spade key, left.....	Pins spade to spade key bracket.....		
1	Spade key, right.....	do.....		
2	Spade key chains.....	Secure spade key to spade.....		
1	Spade pin.....	Pins spade to spade pin bearings.....		
2	Spade points.....	Riveted to spade edge.....		
1	Spade reinforce.....	Brace for point of spade.....		
	Top carriage, complete, consisting of—			
1	Bearing case.....	Riveted to right side plate.....		
1	Bottom plate bushing.....	Riveted to top carriage bottom plate.....		
1	Depression stop.....	do.....		
1	Elevating bearing (left).....	Inside of side plate.....		
1	Elevating bearing (right).....	do.....		
1	Elevating gear case.....	Riveted to top carriage side plate, left.....		
1	Elevating gear cover.....	Bolted to elevating gear case.....		
2	Elevating worm bearings.....	Riveted to top carriage bottom plate.....		
1	Filler ring.....	do.....		
1	Inner plate, left.....	Reinforces side plate inside.....		

Nomenclature of parts of carriage—Continued.

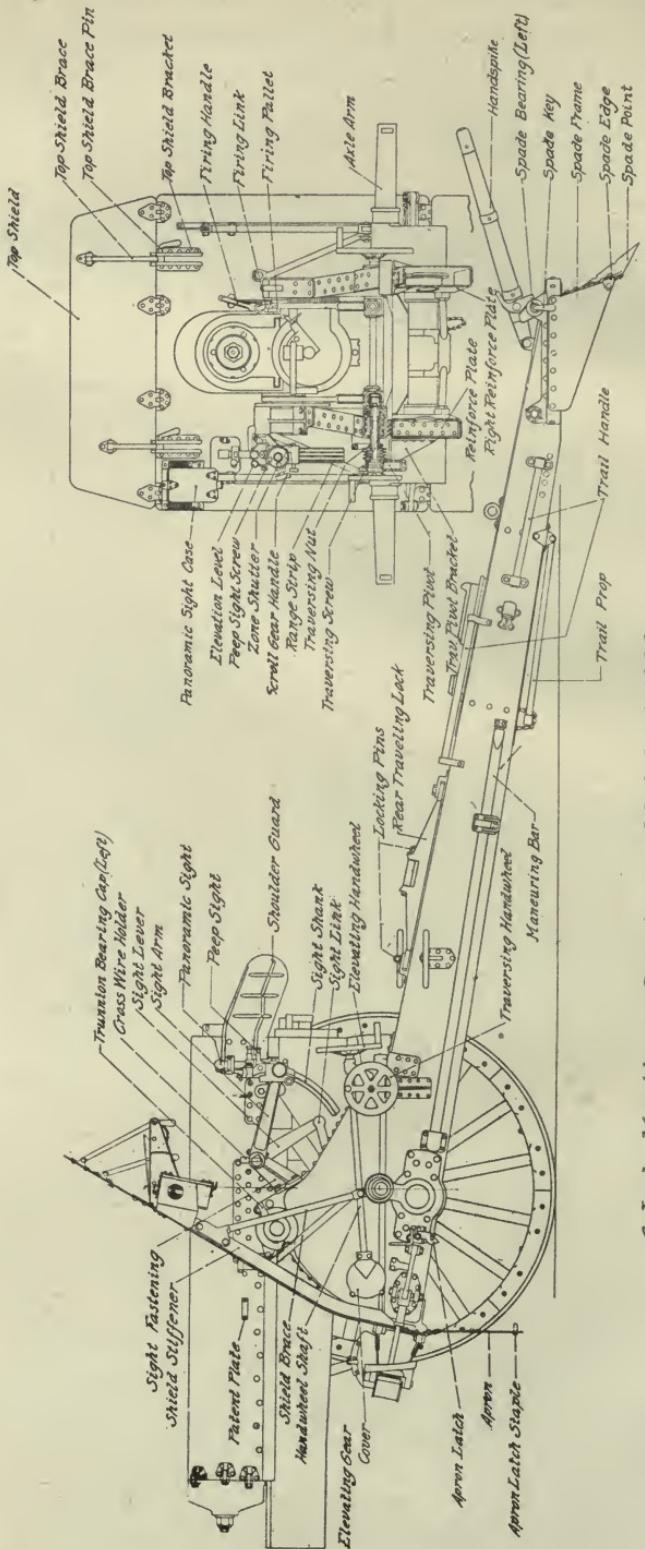
Number.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Top carriage, complete, consisting of—			
1	Continued.			
1	Inner plate, right.....	do.....		
1	Oil tube.....	Extends from right side plate to pinion shaft bearing.		
1	Right side plate.....	Riveted to top carriage bottom plate.		
1	Side plate reinforce, right.....	Riveted to right side plate.		
1	Sight fastening.....	Bolted to trunnion bearing, left.		
1	Sight fastening studs.....	Screws into trunnion bearing, left.		
1	Top carriage bearing plate, left.....	Riveted to top carriage bottom plate.		
1	Top carriage bearing plate, right.....	do.....		
1	Top carriage bottom plate.....	Riveted to side plates.		
1	Top carriage front clip.....	Riveted to top carriage bottom plate.		
1	Top carriage left clip.....	On rear end of left side plate.		
1	Top carriage right clip.....	On rear end of right side plate.		
1	Top carriage side plate, left.....	Riveted to top carriage bottom plate.		
1	Trunnion bearing, left.....	Riveted to side plate.		
1	Trunnion bearing, right.....	do.....		
1	Trunnion cap, left.....	On trunnion bearing, left.		
1	Trunnion cap, right.....	On trunnion bearing, right.		
4	Trunnion cap pins.....	In trunnion bearings and caps.		
2	Trunnion cap swing bolts.....	In trunnion caps.		
2	Worm bearing caps.....	Bolted to elevating worm bearings.		
	Trail, complete, consisting of—			
1	Apron latch base, left.....	Riveted to flange of axle.		
1	Apron latch base, right.....	do.....		
1	Axle, left.....	Riveted to flask and pintle plate.		
1	Axle, right.....	do.....		
2	Axle arm plugs.....	Pinned in axles.		
1	Azimuth scale.....	On left rear trail clip.		
2	Azimuth scale screws.....	Fasten azimuth scale in place.		
2	Bell crank brackets.....	On flasks forward of axle.		
1	Bell crank reinforce plates.....	Under bell crank brackets.		
2	Bottom plate.....	Bottom of sight and tool boxes.		
1	Bracket filler pieces.....	Under upper handle brackets.		
1	Brake beam bracket, left.....	Riveted to front end of flask.		
1	Brake beam bracket, right.....	do.....		
1	Brake beam bracket filler, left.....	Fills space between bracket and pintle plate.		
1	Brake beam bracket filler, right.....	do.....		
1	Brake spring, left.....	Near front end of flask.		
1	Brake spring, right.....	do.....		
1	Cleaning track.....	Riveted to top plate.		
1	Coupling nut.....	Couples axles together.		
1	Cover, left.....	Over sight box.		
4	Cover, right.....	Over tool box.		
4	Cover hinges.....	Riveted to covers.		
1	Cover hinge brackets.....	Riveted to top plate.		
1	Cupboard catch.....	On sight packing No. 8.		
1	End plate.....	Under lower end of trail.		
1	Flask, left.....	Forms side of trail.		
1	Flask, right.....	do.....		
1	Front trail clip.....	Bolted to pintle plate.		
1	Front trail clip liner.....	Riveted in front trail clip.		
1	Front transom.....	Riveted to flasks.		
1	Front traveling lock bearing, left.....	Riveted to reinforce plate in flask.		
1	Front traveling lock bearing, right.....	do.....		
4	Handle brackets.....	Support trail handles.		
2	Hasps.....	On covers.		
1	Intermediate transom.....	Divides sight and tool boxes.		
1	Left reinforce plate.....	Reinforces left flask.		
1	Left seat support.....	Riveted to left flask.		
1	Loading barrow bracket, left.....	Riveted to inside of flask.		
1	Loading barrow bracket, right.....	do.....		
1	Loading barrow pin, with chain and rivet.....	Retains loading hand barrow in stop bearing.		
1	Loading barrow stop bearing.....	On rear transom.		
2	Locks, with bolt snaps, clevises, chains, and rivets.....	Lock covers.		
1	Lunette.....	On lunette transom.		
1	Lunette transom.....	Riveted to flasks near spade end.		
1	Maneuvering bar fastening lever.....	Pinned to maneuvering bar support.		
1	Maneuvering bar fastening spring.....	Actuates maneuvering bar lever.		
1	Maneuvering bar socket.....	Riveted to left flask.		
1	Maneuvering bar stop.....	do.....		
1	Maneuvering bar support.....	do.....		
1	Name plate.....	Riveted to top plate.		
1	Pintle plate.....	Connects flasks at axle end.		
1	Pintle plate bushing.....	Forced in pintle plate.		

IV

3

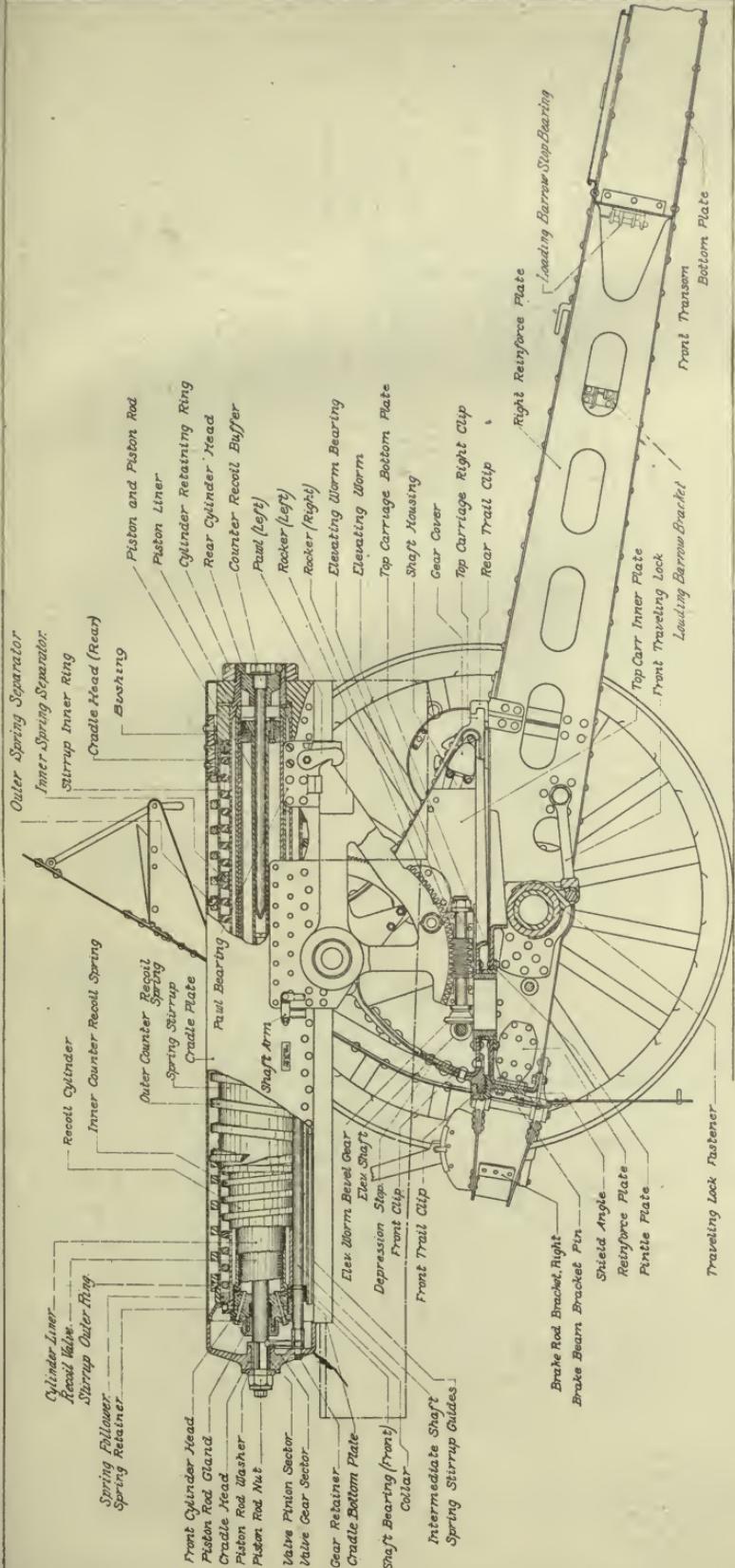
Nomenclature of parts of carriage—Continued.

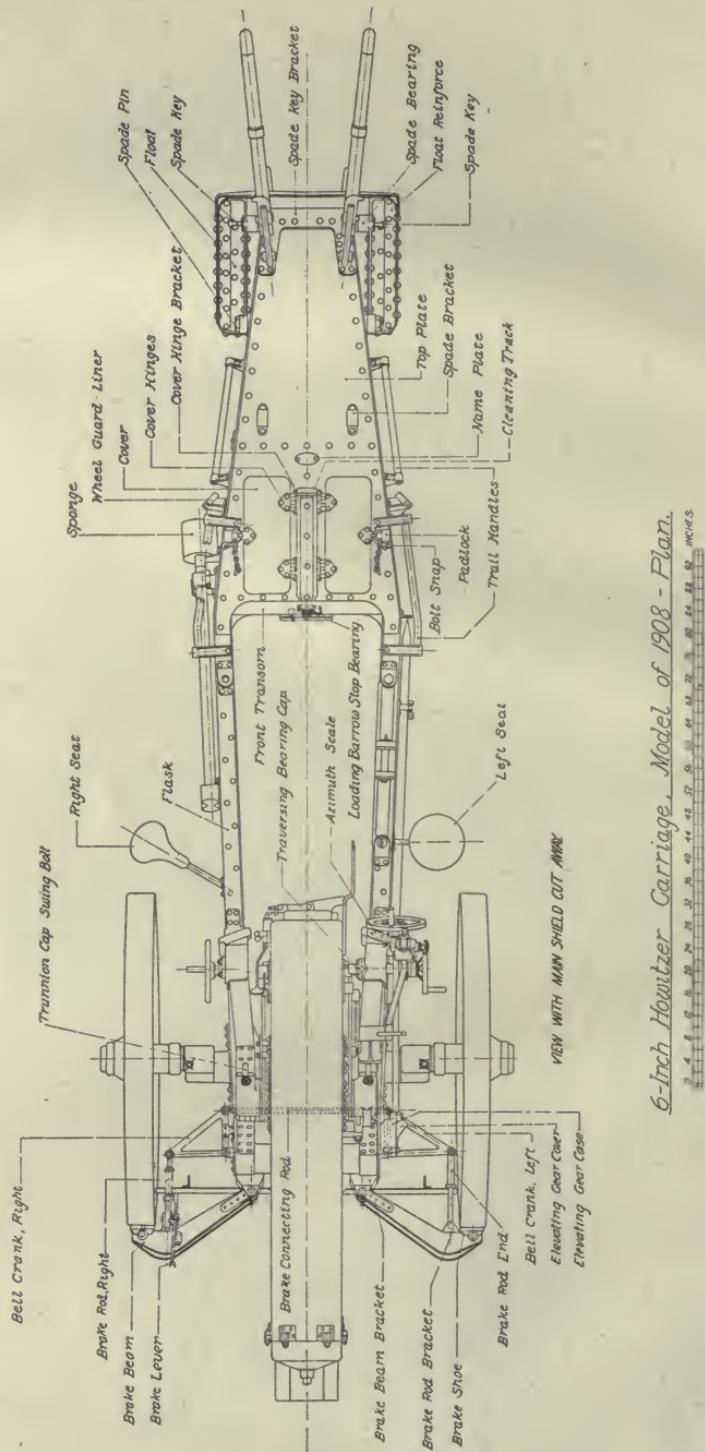
Number.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Trail, complete, consisting of—Contd.			
1	Rammer head stop.....	Riveted to right flask.....		
1	Rear trail clip, le't.....	Riveted to flask.....		
1	Rear trail clip, right.....	do.....		
1	Rear transom.....	do.....		
1	Right reinorce plate.....	Rein'orc's right flask.....		
1	Right seat support.....	Riveted to right flask.....		
1	Sight packing No. 1, and one steel strap.....	Fastened to bottom plate inside of trail.....		
1	Sight packing No. 2, and two steel straps.....	do.....		
1	Sight packing No. 3, and one steel strap.....	do.....		
1	Sight packing No. 4, and two steel straps.....	Fastened to left cover.....		
1	Sight packing No. 5.....	do.....		
1	Sight packing No. 6, and one steel strap.....	Fastened to front transom.....		
1	Sight packing No. 7A.....	Fastened to intermediate transom.....		
1	Sight packing No. 7B.....	Fastened to sight packing No. 7A.....		
1	Sight packing No. 8.....	Fastened to intermediate transom.....		
2	Spade brac'ets.....	Riveted on top plate.....		
1	Spade key bracket.....	Forms lower end of trail.....		
1	Spade pin bearing, left.....	Riveted to flask.....		
1	Spade pin bearing, ri'ght.....	do.....		
1	Sponge staff double hasp.....	On sponge staff fastening.....		
1	Sponge staff double socket.....	Riveted to right flask.....		
1	Sponge staff fastening.....	do.....		
1	Sponge staff fastening bolt, with chain and rivet.....	do.....		
1	Sponge staff stop.....	Riveted to right flask.....		
1	Staple, le't.....	On top plate.....		
1	Staple, ri'ght.....	do.....		
1	Top plate.....	Forms top of lower trail.....		
1	Trail clip stiffener.....	Stiffens right trail clip.....		
1	Trail end reinforce.....	Braces lower end of trail.....		
2	Trail handles.....	In handle brackets.....		
1	Trail prop brac'et, left.....	Under trail.....		
1	Trail prop brac'et, right.....	do.....		
1	Trail prop chain.....	Secures trail prop in folded position.....		
1	Trail prop chain bracket.....	Under bottom plate.....		
1	Trail prop chain swivel.....	Attached to prop chain bracket.....		
1	Trail prop hook.....	On prop chain.....		
1	Trail prop hook button.....	On front transom.....		
1	Trail seat, le't.....	On left seat support.....		
1	Trail seat, right.....	On right seat support.....		
8	Trail seat ri'ets.....	In trail seats and support.....		
1	Traveling lock clip bolt.....	Used in traveling lock clips.....		
1	Traveling lock clip, le't.....	On flange of flask.....		
1	Traveling lock clip, front.....	do.....		
1	Traveling lock clip, right.....	do.....		
1	Traversing pivot bracket.....	Riveted to left flask.....		
1	Traversing pivot reinforce plate.....	Inside of left flask at traversing pivot bracket.....		
4	Upper handle brackets.....	Riveted to flasks and top plate.....		
2	Upper trail handles.....	In upper handle brackets.....		
2	Wheel curv'ds.....	Riveted to flasks.....		
2	Wheel guard liners.....	On wheel guards.....		
2	Wheel guard liner screws.....	Secure liners to wheel guards.....		
2	Trail prop, consisting of—			
2	Prop eyes.....			
1	Prop foot.....	Under trail.....		
2	Prop tubes.....			
	Traversing mechanism, consisting of—			
1	Ball thrust bearing.....	In traversing pivot.....		
1	Clamp.....	Secures traversing screw dust guard.....		
1	Thrust bearing nut.....	In traversing pivot.....		
1	Thrust bearing nut locking screw.....	Secures thrust bearing nut in adjustment.....		
2	Traversing bearing caps.....	On top carriage left clip.....		
4	Traversing bearing studs.....	Secure caps to top carriage left clip.....		
1	Traversing handwheel, consisting of—			
1	Counterbalance.....			
1	Handwheel body.....			
1	P'ub.....			
1	Instruction plate.....	On traversing screw.....		
1	Reinforce piece.....			
1	Sleeve.....			
1	Spindle.....			



6-Inch Howitzer Carriage, Model of 1908.
Left Elevation and Partial Rear View.

Scale: 1 Inch = 100 inches





Nomenclature of parts of carriage—Continued.

Number.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Traveling mechanism, consisting of— Continued.			
1	Traversing nut.....	In top carriage left clip.....		
1	Traversing nut dust guard.....	On inner end of traversing screw.....		
1	Traversing pivot.....	In traversing pivot bracket.....		
1	Traversing pivot washer.....	Under nut on traversing pivot.....		
1	Traversing screw.....	In traversing nut.....		
1	Traversing screw dust guard.....	On screw, between pivot and nut.....		
1	Traversing screw washer.....	On right end of screw.....		
2	Wheels, 60-inch, complete, consisting of—			
16	Carriage bolts and nuts.....	Secure spokes to hubs.....		
16	Dowels.....	Between felloe segments.....		
16	Felloe rivets and washers.....	Through felloe segments.....		
16	Felloe segments.....	Form felloes of wheels.....		
2	Hub bands.....	Screwed on hub boxes.....		
2	Hub boxes.....			
2	Hub caps.....	On ends of hub boxes.....		
2	Hub latches.....	Actuate hub latch plungers.....		
2	Hub latch pins.....	Pin hub latches to plungers.....		
2	Hub latch plungers.....	Lock hub caps in place.....		
2	Hub latch springs.....	On hub latch plungers.....		
2	Hub liners.....	Forced into hub boxes.....		
2	Hub rings.....	Outer flanges of wheel hubs.....		
2	Lock washers.....	Between hub bands and hub rings.....		
2	Oil valves.....	Slide in hub caps.....		
2	Oil valve springs.....	Around oil valves.....		
2	Oil valve washers.....	On inner ends of oil valves.....		
16	Spokes, left.....			
16	Spokes, right.....			
2	Tires.....			
16	Tire bolts, nuts and washers.....	Through tires and felloe segments.....		
2	Wheel hooks.....	On outside of hubs.....		
2	Wheel hook bushings.....	Bearings for wheel hooks.....		
2	Wheel fastenings, complete, consisting of—			
2	Wheel fastenings.....	On ends of axle.....		
2	Wheel fastening plugs.....	In wheel fastenings.....		
2	Wheel fastening plungers.....	Hold wheel fastenings in place.....		
2	Wheel fastening springs.....	Actuate wheel fastening plungers.....		

DESCRIPTION OF THE CARRIAGE.

(Plates VII, VIII, and IX.)

The 6-inch howitzer carriage, model of 1908, is of a type known as the variable recoil, in which the howitzer is permitted a sufficient length of recoil on the carriage at low angles of elevation to render the carriage stationary under firing stresses, but in which the length of recoil is reduced to maintain clearance from the ground at high angles of elevation.

For the purpose of description the carriage is considered as composed of the following groups, viz, cradle (complete), top carriage, elevating mechanism, quick return mechanism, trail (including axle), traversing mechanism, road brake, traveling lock, shield, and wheels. A detailed description of the above groups follows:

CRADLE (COMPLETE).

Under this group are considered the cradle, the recoil-controlling parts, the valve-turning mechanism, and the firing mechanism.

The cradle supports the howitzer, guides it in recoil, and forms a housing for the recoil mechanism and parts of the valve-turning mechanism. It consists of the cradle bottom plate, gun slides, spring stirrup guides, cradle plate, cradle head (rear), trunnions, pawl bearings, shoulder guard, and several other attachments riveted thereto.

The cradle bottom plate is made of forged steel. It is shaped on the underside so as to form two clips. These clips are lined with bronze gun slides and form ways in which the howitzer recoils.

The spring stirrup guides are riveted to the top of the cradle bottom plate. Their object is to form a bearing and support for the projections of the stirrup outer ring and also for guides for the spring stirrup during the recoil.

The cradle plate is arch shaped and made of flange steel, the sides being riveted to the flanges on the cradle bottom plate. The cradle head (rear) is made of cast steel, bushed with a bronze bushing. It is riveted to the rear end of the cradle plate and is used to take the thrust of the outer spring column and support the rear end of the spring stirrup.

The trunnions are riveted on each side of the cradle plate, and are so located as to bring the preponderance of the loaded howitzer at the breech and of the unloaded piece at the muzzle, thus aiding the movements to and from the loading position. The trunnions are made of forged steel bored out in the center to reduce the weight. Bronze bushings forced on these trunnions form bearing surfaces.

The pawl bearings are forged steel pieces riveted to each side of the cradle plate near the rear end. Bosses on these bearings form supports for the pawls of the quick return mechanism. The pawls are assembled to the pawl shaft, which extends through the pawl bearings and the cradle.

The shoulder guard is a pressed flange steel plate riveted to the left side of the cradle. Clips for securing the cradle head and spring retainer to the cradle are riveted to the front end of the cradle plate.

The recoil controlling parts of the carriage include the counter-recoil springs, spring stirrup, recoil cylinder, cylinder liner, recoil valve, piston, counterrecoil buffer, and cradle head.

Immediately inside the cradle plate are located the four helical spring sections comprising the outer counterrecoil spring column. The sections are separated by the outer spring separators. The rear end of the column bears against the bushing of the cradle head (rear) and the front end against the stirrup outer ring. The stirrup outer ring is screwed and pinned to the front end of the spring stirrup.

The spring stirrup is a forged steel tube, which separates the outer and inner spring columns. Inside the rear end of the spring stirrup is threaded and pinned the stirrup inner ring, which is bored out so as to form a sliding fit for the recoil cylinder. Immediately

inside the spring stirrup are located the four helical spring sections composing the inner counterrecoil spring column. These sections are similarly separated by the inner spring separators. The rear end of the column bears against the stirrup inner ring, while the front end bears against the spring follower.

The spring follower is a bronze ring which fits over the recoil cylinder in front of the inner counterrecoil spring column.

The forged steel spring retainer is secured to the cradle by means of two lugs and swing bolts. It is located immediately in front of the spring stirrup and spring follower, and serves to hold the springs in position when the cylinder is removed.

The springs are assembled in the carriage under sufficient tension to return the howitzer into battery at maximum angles of elevation. The approximate force exerted by the spring at assembled heights is 3,000 pounds for the outer column and 2,900 pounds for the inner.

The cylinder extends to the rear through the stirrup inner ring and the lug of the howitzer, and is locked to the lug by the cylinder-retaining ring screwed on its rear end. To prevent entrance of dirt the clearance between the cylinder and the stirrup inner ring is closed by means of a felt washer.

The front cylinder head closes the forward end of the cylinder. The stuffing box is packed with four rings of Garlock hydraulic waterproof packing, held by the bronze piston-rod gland, threaded to the cylinder head. Two holes through the walls of the cylinder head are closed by filling and drain plugs and copper gaskets. The rear cylinder head closes the rear end of the recoil cylinder. It is threaded to the cylinder, and in turn is bored and threaded for the counterrecoil buffer. Both the front and rear cylinder heads are supplied with fiber gaskets to insure oil-tight joints.

The cylinder liner is a tube assembled inside the cylinder, the front end being threaded for a short distance and the rear end fitting into a tapered seat of the cylinder. A threaded plug through the cylinder and extending into the liner prevents any turning of the liner in the cylinder, and similarly a pin in the howitzer lug prevents rotation of the cylinder in the lug.

Between the end bearings of the liner the cylinder is counterbored to a larger internal diameter. The space thus created is called the by-pass. It is utilized for the passage of oil from the front to the rear of the piston head.

Parallel to the axis of the liner are cut three rows of rectangular ports through its wall. These rows are 120° apart, and are for the purpose of connecting the valve chamber with the by-pass. At the extreme rear of the liner are drilled additional holes for the same purpose.

Fitting with a very small clearance inside of the cylinder liner, but free to rotate in it, is the recoil valve. This valve is a hollow cylinder having three equally spaced longitudinal ribs or keys on its inner surface. Rows of holes parallel to each other and to the axis of the valve are drilled through the wall. The number of holes in any one row is practically the same as the number in each of the rows 120° from it. The total number of holes in three rows 120° apart varies from that in any other three rows 120° apart, except where the length of recoil is the same, and depends on the number of apertures needed at any given length of recoil for the passage of the oil from the interior of the valve through the liner ports into the by-pass and back to the other side of the piston head.

The bronze piston liner working inside the valve and bolted to the head of the piston rod has three notches or keyways which fit over the ribs or keys of the recoil valve. This piston liner fits closely inside of the valve and practically prevents any oil from passing from one side of the piston head to the other except through the holes in the valve and liner and the by-pass. The piston rod extends through the stuffing box in the front cylinder head and through the valve pinion sector, as hereafter described. The rear end of the piston rod is bored out to receive the counterrecoil buffer, which fits into this bore with a very small clearance.

The buffer is threaded in the rear cylinder head and moves with it during recoil. In counterrecoil the oil caught in the piston-rod bore can escape only by the small clearance around the buffer. This checks the return into battery so that very little shock and derangement of aim is experienced.

The front end of the cradle is closed by the cradle head, a forged-steel piece with four projecting lugs. It is secured to the cradle plate by four clips and swing bolts. The cradle head is bored out and is used to cover parts of the valve-turning mechanism.

The valve-turning mechanism consists of the valve pinion sector, the valve-gear sector, the intermediate shaft, the valve link, and several other smaller parts connected with it.

The hub of the valve pinion sector fits into the bearing formed by the bore in the cradle head. A clip interlocking with the flange on the cradle head prevents longitudinal movement. The front end of the piston rod passes through the valve pinion sector. Two keys on the piston rod, so placed as to prevent assemblage in any but the correct position, fit into key slots in the sector and bronze piston-rod washer. The latter is located immediately in rear of the piston-rod nut. The piston rod and valve pinion sector are free to revolve in the cradle head, but longitudinal movement is prevented by the piston-rod nut and shoulders on the rod and sector.

A zero mark on the piston-rod washer, together with a scale on the hub of the cradle head, serves to indicate the elevation of the howitzer for which the valve is set.

The valve pinion sector meshes with the valve-gear sector, which is located on the forward end of the intermediate shaft. This shaft is located in the lower left corner formed by the cradle plate and the cradle bottom plate. For convenience in assembling, the valve-gear sector is made removable from the shaft and is secured in its proper relation longitudinally with regard to the valve pinion sector by the gear retainer. The gear retainer is a short stud screwed and pinned in the hub of the valve-gear sector and extending through the hole in the cradle head, to which it is secured by a nut and split pin.

The intermediate shaft is supported by the front and rear bronze bearings riveted to the cradle plate and cradle bottom plate. The shaft is squared near its rear end and is fitted with the shaft arm, which projects through the rear shaft bearing and through the side of the cradle. The shaft arm is connected by means of the valve-link trunnions to the valve link, which in turn is connected to the lug on the left trunnion cap of the top carriage.

ACTION OF THE MECHANISM DURING RECOIL.

The gears and other parts of the valve-turning mechanism are so assembled that as the howitzer is elevated the piston and piston rod, and with it the valve, are rotated inside the liner through a proportionate angle. Forty-five degree movement of the howitzer corresponds to a 100° movement of the valve. As stated above, there are three rows of ports in the cylinder liner 120° apart. Similarly there are three sets of rows of holes in the valve, the corresponding rows of each of the three sets having practically the same number of holes, while for all adjacent rows, except such as have identical lengths of recoil, the number varies. For the howitzer at 5° depression, the three rows having the largest number of holes are opposite the ports of the liner, while for higher elevation the valve turns, putting rows with a less number of holes opposite the ports. In this way the orifice through which the oil passes from one side of the piston head to the other is automatically reduced as the howitzer is elevated.

When the howitzer recoils it pulls with it the cylinder, cylinder liner, and valve. The piston, being fastened to the cradle head, remains stationary. The oil in front of the piston head is forced through such holes in the valve as may be opposite the liner ports and through the ports into the by-pass. From there is it forced again through the ports and holes in the valve into the valve chamber in rear of the piston head.

The energy of recoil of the piece is absorbed by the resistance which the oil offers to being forced through the small openings and by the resistance of the counter-recoil springs. The energy stored in the springs returns the piece to battery. This return movement is checked by the counterrecoil buffer and limited by the gun lug coming in contact with the rear of the cradle.

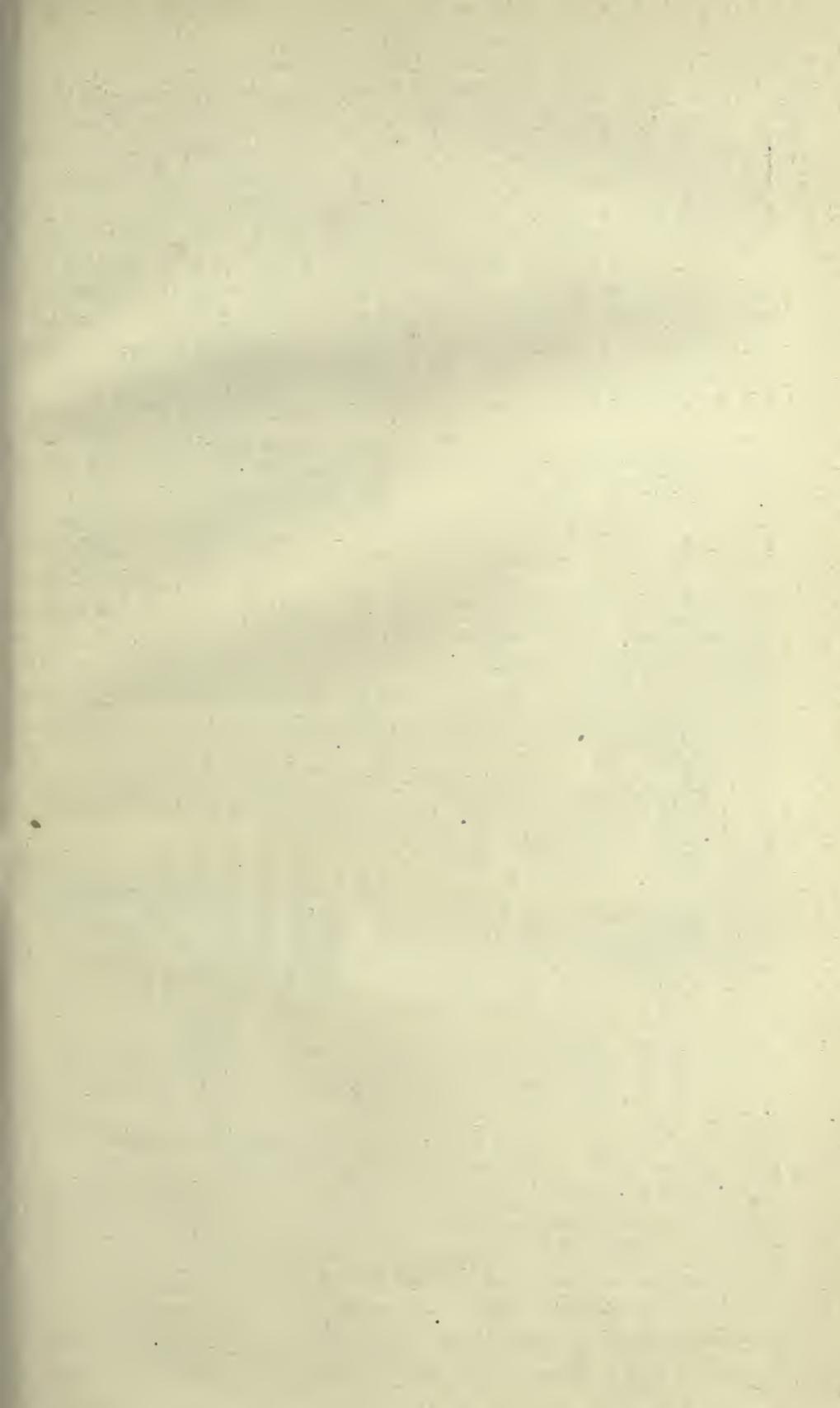
The number of holes in the valve is calculated so as to stop the howitzer at a recoil of 63 inches at 5° depression and at a recoil of 26 inches at 40° elevation.

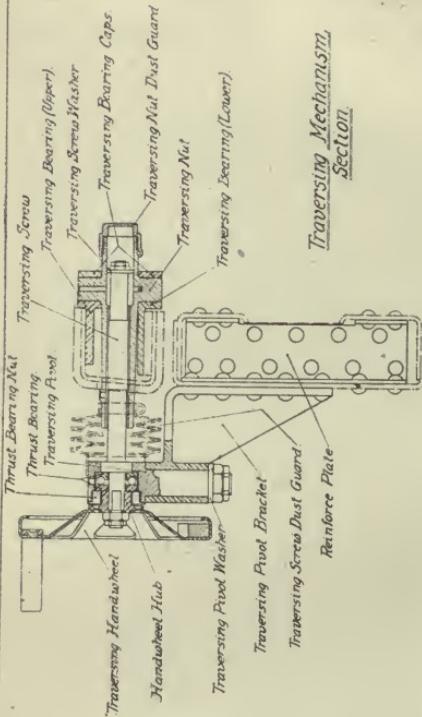
The carriage mechanism for firing the howitzer is as follows: A firing pallet has its bearing arm assembled in a bracket bolted to the rear end of the cradle on the right side. The pallet or lip is in such a position as to engage an arm on the trigger shaft of the breech mechanism. A helical spring in the bracket tends to hold the pallet in a position free from the trigger. In a second bearing of the bracket, above and parallel to that of the firing pallet, is assembled the firing shaft, having on its rear end a crank arm which is connected to a similar arm of the firing pallet by two links. The rotary movement of the pallet in its bearing, caused by its return spring, is limited by a stop pin in the bracket coming in contact with a projection on the firing shaft. The forward end of the firing shaft is squared and fitted with a small ratchet shaft trip collar. The firing-handle hub adjacent to the shaft trip collar and free to turn on the shaft carries a spring pawl trip latch which engages a notch of the trip collar. The front end of the firing-handle hub is slotted to receive the rear arm of the pawl handle, as hereafter described. A helical spring in the bracket rotates the firing-handle hub into firing position. In another bearing in the bracket is located an adjusting screw which limits the movement of the firing handle.

The action of the firing mechanism is as follows: Pulling the handle rotates the trip latch, shaft trip collar, firing shaft, and pallet until the head of the trip-latch plunger, on the end of which is located the trip latch, strikes the adjusting screw in the bracket when the trip latch is released from the collar and the lower return spring returns the pallet and firing shaft to their original position. The trigger should fire the piece just before the trip latch releases. When the handle is released the upper spring throws it upward and resets the mechanism in the firing position. The piece may be fired by a lanyard attached directly to the trigger shaft of the breech mechanism, but should habitually be fired by the cradle-firing mechanism.

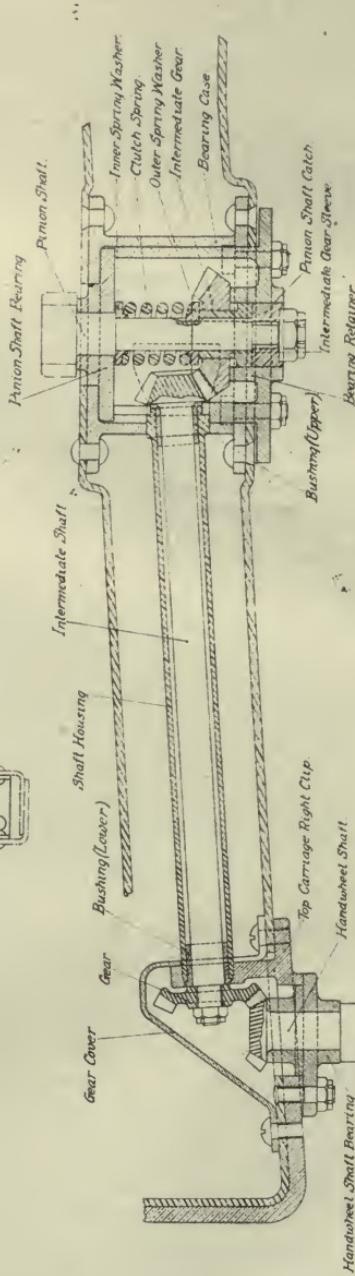
THE TOP CARRIAGE.

The top carriage is built up of flange steel plates pressed into shape and riveted together. The two side plates are flanged all around, the flanges turning inward. The bottom plate rests on the





Traversing Mechanism.
Section.



Quick Return Mechanism.
Section.

(For carriage Model of 1908)

Quick Return Handwheel

lower flanges of the side plates and extends upward in front, forming a stiff connection for the sides, which are further reinforced by inner plates of flanged steel. A bronze bushing extends through an opening in the bottom plate and fits in the pintle plate bushing of the trail. A steel filler ring is riveted on the underside of the bottom plate. A forged steel top carriage front clip riveted to the front of the bottom plate engages the front trail clip.

Bronze top carriage left and right clips riveted on the rear end of the top carriage side plates engage the left and right rear trail clips. The top carriage left clip has a projecting arm with a bearing for the rear end of the handwheel shaft of the elevating mechanism. Vertical bearings for the traversing nut are cast integral with the top carriage left clip.

On the top of the side plates are located the cast steel trunnion bearings which support the trunnions of the cradle. The rear of the left trunnion bearing forms a seat for the sight fastening. The trunnion caps are hinged to the trunnion bearings and secured by the trunnion cap swing bolts.

Near their forward ends the side plates are stamped to form vertical and parallel seats for the flanges of the elevating bearings of the elevating shaft. A similar vertical seat is formed near the center of the right side plate for the bearing case of the quick-return mechanism. Top carriage bearing plates of bronze, riveted under the forward ends of the side plates, bear upon the upper surfaces of the brake-beam brackets of the trail.

Other parts riveted to the top carriage are the bronze elevating-gear case on the left side plate, the bronze depression stop on the upper edge of the front face of the bottom plate, and the elevating-worm bearings just inside the inner plates.

The bearing surfaces of all of these riveted parts are finished after riveting, and the top carriage, complete, is regarded as one interchangeable piece.

THE ELEVATING MECHANISM.

The elevating mechanism consists of the rockers, rocker brace, worm, elevating shaft, and handwheel shaft, and their accompanying parts.

The rockers are made of forged steel. A circular hole at the center of the arc fits over the cradle trunnion. The rockers are located between the rim bases of the cradle trunnions and the trunnion bearings of the top carriage. Lugs on their extreme rear end engage pawls of the quick-return mechanism, as hereafter described. A tubular rocker brace passing under the howitzer connects the rockers and insures their action as a unit. Bronze washers are riveted to the inside of the rockers and afford a wearing surface against the top carriage trunnion bearings.

The worm teeth of the rockers engage the worms lying in the elevating-worm bearings riveted to the bottom plate and inner plates of the top carriage. The worm-bearing caps are bolted to the bearings. Bevel gears on the forward ends of the worms engage gears on the elevating shaft. The right end of this shaft is supported in the right bearing bushing, which is secured by bolts to the elevating bearing, right. The left end of the shaft is supported by the elevating bearing, left, on the inside of the top carriage and supports the elevating gear on the outside. The elevating-gear case on the left side plate, together with the elevating-gear cover forms a bearing for the forward end of the handwheel shaft; a pinion on this shaft meshes with the gear on the elevating shaft. When the handwheel shaft is rotated, by means of the elevating handwheel located on its rear end, the gears transmit the motion through the elevating shaft and the worms to the rockers, forcing them to rotate about the trunnions, elevating or depressing the cradle.

Drain plugs are provided in the elevating-gear case and worm-bearing caps for draining off the excess oil.

QUICK-RETURN MECHANISM.

The quick-return mechanism is designed to afford means of quickly returning the cradle and howitzer to the loading position and releasing them from the elevating mechanism without interfering with the laying of the piece or disturbing the setting of the sights. By this means the howitzer can be brought to the loading position without changing the sight setting, thereby saving time in firing.

The quick-return mechanism consists of the pawls, the handwheel shaft, the intermediate shaft, the pinion shaft, and accompanying parts of each. The pawls are heavy hooks supported on bosses of the pawl bearings and connected through the cradle by the pawl shaft. The shaft is operated by the pawl handle on the right pawl. The pawls have spring plungers which bear against projections on the bearings and tend to keep the pawls locked to the rockers.

For quickly bringing the howitzer to loading position when the pawls are released from the rockers a train of gears is provided in the right side of the top carriage which act on the cradle through the quick-return rack bolted to the right trunnion. The bearing case is a short, hollow cylinder of bronze riveted between the right side plate and the inner plate (right) of the top carriage. The inner end of the bearing case is bored to a smaller diameter and fitted with a bronze hub called the pinion-shaft bearing. The bearing retainer telescopes in the larger bore of the bearing case and holds the flange of the pinion-shaft bearing firmly against the shoulder in the bearing case. The pinion shaft projects through the pinion-shaft bearing

and bearing retainer and has a pinion formed on its inner end which meshes with the quick-release rack.

The outer end of the pinion shaft is squared and fitted with the pinion-shaft clutch which meshes with the intermediate gear sleeve mounted on the pinion shaft and carrying the intermediate gear. The end pressure on the clutch is supplied by the clutch spring between the inner and outer spring washers mounted on the shaft.

The intermediate gear meshes with a bevel pinion on the upper end of the intermediate shaft which is carried in bearings in the shaft housing assembled between the bearing case and the top carriage right clip. A bevel gear on the lower end of the intermediate shaft meshes with a pinion on the handwheel shaft which is supported in the handwheel-shaft bearing bolted to the clip. A bronze gear cover screwed to the inside of the top carriage right clip incloses the lower pair of gears. The shaft housing rests in a cup-shaped socket at its lower end and is locked in position when the bearing retainer is assembled. Means of oiling the inner bearing of the pinion shaft is provided through an oil tube leading from the right side plate through the bearing case to the pinion-shaft bearing.

When the pawls are disengaged one revolution of the quick-return handwheel elevates or depresses the cradle about 9.8°.

As will be seen from the above, by elevating or depressing the rocker the gears and handwheel of the quick-return mechanism will be actuated also, while by turning the quick-return handwheel only the cradle and handwheel move.

By means of the intermediate gear sleeve and pinion-shaft clutch, described above, it is possible to move the rocker without actually moving the quick-return mechanism except the pinion shaft, provided the resistance at the quick-return handwheel is sufficient to overcome the resistance of the clutch. This may occur when the howitzer is fired, where, due to play in the pawls and elevating worms, a certain movement of the howitzer takes place during firings and the mass of quick-return handwheel and shafts resist movement sufficiently to bring the clutch into action.

SAFETY FIRING DEVICE.

The bronze safety latch bearing is riveted to the right pawl bearing and forms a support for the safety latch and a seat for the safety latch plunger and spring. The rear arm of the pawl handle engages the slot in the firing handle hub when the pawls are released, making it impossible to pull the firing handle. The pawl handle is locked in this position by the hook of the safety latch engaging the notch on the top of the right pawl. The safety latch plunger bears against a projection on the safety latch and tends to keep the latch hooked.

When the cradle and howitzer are brought back to the firing position the lower arm of the safety latch comes in contact with the rocker and releases the pawl handle.

TRAIL.

The flasks of the trail are made of flange steel, shaped to form a channel section and reinforced to form a box section. The forward ends are connected with each other by means of the flange steel pintle plate. The latter forms a support for the pintle which engages in the corresponding part of the top carriage bottom plate.

The axle is made in three parts, the two axle arms and the body. In assembling the axle arms are forced onto the body of the axle. The inner ends of the axle arms are flanged. Rivets through these flanges and corresponding flanges on the pintle plate connect the axle to the flasks. The spindles of the axle arms are offset 6.5 inches from the body. They are given a slight set so as to bring the lowest spoke in the wheel vertical when the carriage is limbered. Both the axle and axle arms are bored out to reduce weight; the bore in the arms is closed at the inner end by a plug. The space thus created is used as a reservoir for the lubricating oil.

The pintle plate bushing is riveted to the pintle plate $12\frac{1}{2}$ inches forward of the axis of the wheels and forms a circular seat for the bottom plate bushing on the top carriage. Forged steel rear trail clips riveted on the upper flanges and sides of the flasks and a front trail clip bolted to the front of the pintle engage with the rear and front clips of the top carriage.

For about half its length from the axle the trail is open to allow the howitzer to pass between the flasks when fired at the higher angles of elevation. In this open part each flask is strengthened inside by a flange steel reinforce plate. At the middle of the trail the flasks are connected and braced by the front transom; below this the rear and the lunette transoms perform the same function. A flange steel end plate, riveted to the lower flanges of the flasks, is bent up around their extreme rear ends, while the top plate covers the trail from the front transom to the rear end.

The cast-steel spade key bracket rests on the top plate at its lower end and is riveted through it to the flasks. It has also a flange turned downward over the end plate and riveted to the latter and to the end flanges of the flasks. This spade key bracket has a heavy lug on each side bored to receive the keys which lock the spade in position and is surmounted by projections for the engagement of the handspikes hinged to other lugs farther forward on the bracket.

Six other steel pieces—the spade bearings, right and left, the spade pin bearings, right and left, and the spade brackets—are riveted to the trail as additional points of attachment of the spade; the spade

bearings and spade pin bearings are located on the sides of the flasks and are used to receive the spade pin. The spade brackets are located on the top plate and are used to secure the spade in a folded position.

The trail end reinforce is a flange steel piece riveted to the end plate. It has a flanged opening to receive the horn of the top carriage of the limber. The lunette transom riveted to the flasks and the end plate supports the lunette, a forged steel piece having a seat for engaging the pintle of the limber.

A bottom plate closes the underside of the trail between the front and rear transoms; the space in the trail thus created is divided into right and left compartments by the intermediate transom riveted to the front and rear transoms and the bottom and top plates. Flanged openings in the top plate closed by hinged covers give entrance to these compartments, of which the right is used as a tool chest and the left as a sight box. The covers are secured by hasps and padlocks.

Four trail handles are riveted to the trail for use in limbering; a trail prop is hinged in brackets under the rear transom. The trail prop when not in use is swung forward and its foot held against the bottom plate by a chain with a hook slipped over a button on the front transom.

Two seats for gunners serving the piece are mounted on brackets riveted to each side of the trail. Attachments for carrying the sponge and rammer are provided on the right flask, and attachments for carrying the maneuvering bar are provided on the left flask. Wheel guards with removable cast-iron liners riveted to each side of the flasks protect the latter from the limber wheels. Other brackets for the attachment of the front and rear traveling locks, loading barrow, brakes, and traversing mechanism are riveted to the trail, as described later. A steel cleaning track is riveted to the top plate of the trail between the covers for use when it is desired to clean the howitzer slides.

A name plate, giving the number of the carriage, model, name of manufacturer, year of completion, and initials of inspector, is riveted on the top plate.

In all reports and correspondence the carriage is to be designated by the number and model given on the name plate.

The spade frame is a plate of flange steel stiffened by the spade reinforce riveted to its rear face and placed crosswise to the center line of the trail, with wings extending to the front. Between these wings and parallel to them, with flanges butting against and riveted to the spade frame, are two spade braces, whose upper portions extend above the frame and are riveted to the forged-steel spade bearings. Riveted to the wings of the spade frame and to the spade

braces is the float, and on this is a steel angle stiffener, called the float reinforce. The float and the float reinforce form a heavy rail across the top of the spade frame.

The spade pin passes through the forward holes of the spade bearings and through the spade-pin bearings riveted to the trail. The spade keys, in conjunction with the rear holes of the spade bearings and corresponding holes in the spade-key bracket, serve to lock the spade in its position in rear of the trail when the carriage is unlimbered. For traveling the spade is rotated about the spade pin to the top of the trail and secured by means of the spade keys. A hardened-steel wearing edge is riveted to the lower edge of the spade frame, and hardened-steel spade points are riveted to the spade frame and spade edge. Both the spade edge and spade points can be replaced in the service.

Two handspikes are mounted on the spade-key bracket of the trail in such a manner as to fold forward on the trail when not in use; in this position they are held by the folded spade. When in use, they are locked to the projecting lugs of the spade-key bracket by the handspike latches, hinged to the central webs of the handspikes.

The apron-latch body is pivoted on the apron-latch base, riveted to the flanges of the axle arms. The lower end of the latch body terminates in a hook, which engages the latch staple riveted to the apron plate and holds the latter in traveling position. To prevent accidental disengagement of the hook from the staple, the opening of the hook is closed by a plunger seated in the latch body and pressed outward into position by a spring.

TRAVERSING MECHANISM.

The traversing mechanism consists of the traversing screw and handwheel, the traversing pivot, the traversing nut, the thrust-bearing nut, the ball thrust bearing, and the traversing-pivot brackets and their accompanying parts.

The bronze traversing pivot swivels on a vertical axis in the steel traversing-pivot bracket, the latter being riveted to the left trail flask. The upper part of this pivot is bored horizontally to form a housing for the ball thrust bearing.

The thrust-bearing nut is bored to fit over the hub of the handwheel and threaded to the traversing pivot. The ball thrust bearing takes the thrust between this nut and the traversing screw. The thrust-bearing nut is in adjustment when the end play of the screw is taken up without any interference with the movement of the balls.

The traversing nut, which is of bronze, swivels on a vertical axis in bearings on the top carriage left clip. On its inner end is screwed the traversing-nut dust guard. The traversing screw is threaded into the traversing nut with a left-hand thread and extends outward

through bearings in the traversing pivot to the handwheel. A dust guard, located on the screw between the nut and the pivot, protects the screw against dust and dirt. When the handwheel is turned, the traversing nut is forced along the screw and carries the top carriage with it. Angular movement of the axis of the screw as the top carriage turns about the pintle center is allowed for by the vertical bearings of the nut and the pivot. The collar on the screw also serves as a stop to limit the traversing movement to the left, while a washer nut assembled on the inner end of screw limits movement in the opposite direction.

An azimuth scale is attached to the left rear clip of the trail and in conjunction with a zero mark on the top carriage indicates the position in azimuth. The scale is graduated to minimum readings of 5 mils.

ROAD BRAKE.

The brake consists of the brake beams, the brake shoes, the brake lever, the bell cranks, the brake rods, the connecting rod, the brake segment and rack, and their accompanying parts.

The two brake beams are each built of a flange steel body having a brake-shoe bearing riveted to one end and two hinges for attachment to the brake-beam bracket riveted at the other end. Near the brake-shoe bearing the flanges of the beam are stiffened by the brake-beam stiffener, and on the inside face of the beam is riveted the brake-rod bracket. The brake segment, with its rack, is riveted to the top of the right brake beam and to the brake-rod bracket. The flange at the rear of the brake segment is widened and forms a stop for the brake lever when the brakes are released. To the brake-shoe bearing is pinned the brake shoe, which bears against the tire of the wheel. The hinges on the brake beam are pivoted to the brake-beam bracket, riveted to the front end of the trail flask.

The hub of the brake lever is pinned in the right brake rod bracket, and is bored eccentrically. The brake eccentric strap turns freely on the hub of the brake lever and is fastened to the right brake rod, which in turn is fastened to the right bell crank mounted in the bell-crank bracket riveted to the flask of the trail. The connecting rod links the right bell crank to the left bell crank, and the latter is connected directly through the left brake rod to the brake-beam bracket of the left brake beam. A leaf spring attached to each flask bears against the bell cranks, thus preventing the swinging or whipping of the entire brake system.

When the brakes are set, the brake lever is held by the teeth of the brake-segment rack engaging the brake-lever catch, a small steel piece riveted to brake lever. For the purpose of adjustment for worn brake shoes, etc., the brake rods are made in two parts screwed together. The brake may be used as a firing as well as a road brake.

THE TRAVELING LOCK.

To relieve the pointing mechanisms from undue stresses in traveling, two distinct means of locking the howitzer to the trail are provided. The front traveling lock is in shape an inverted V with a yoke at the apex embracing a lug under the breech of the howitzer, and the ends of the legs bolted to bearings riveted inside the trail to the flask reinforce plates. A pin with a spring catch is passed through the yoke and the howitzer lug and is chained to one of the legs. When not in use the locking pin is withdrawn and the yoke is disengaged from the howitzer lug, rotated upon the bolts and engaged in the traveling lock fastener clamped on the axle, where it is again secured by the locking pin. The front traveling lock should be used only in an emergency, when there is not time to retract the howitzer to the position afforded by the rear traveling lock.

The rear traveling lock consists of a bar with one end hinged in a clip on the left flask and the other end secured by a locking pin in a similar clip on the right flask. The middle of the bar is shaped as a yoke to embrace the lug of the howitzer and is provided with a locking pin for securing the latter in the bar. When the howitzer is drawn back to the rear traveling lock the load on the wheels of the carriage and limber is equalized, and the howitzer should habitually be kept in this position except when unlimbered and ready for firing. When not in use the rear traveling lock is swung forward and its right end secured in a third clip on the left flask.

The maneuvering bar and retracting chain are used to retract the howitzer to the rear traveling lock. To accomplish this, the howitzer is disconnected from the cylinder, the toggle of the retracting chain is passed through the hole in the lug of the howitzer, and the maneuvering bar put through the ring of chain. The side of one of the holes in the reinforced plate of the flask may be used as a fulcrum for starting the howitzer. The maneuvering bar may be left in the chain ring for the balance of the pull, or may be used directly back of the lug of the howitzer. The cradle should be placed at the proper elevation and azimuth before the retracting operation is begun. The shifting of the weight of the howitzer should be done while the carriage is limbered, both to avoid lifting the extra weight in limbering and to avoid the tendency of the piece to slide out of the cradle when it is elevated and not held by the recoil springs.

THE TRAVELING COVERS.

The traveling breech cover protects the howitzer slides, breech mechanism, and firing mechanism from dust and dirt. The cover is first placed over the upper lug of the breech hoop and is then drawn

forward. A pocket is provided on the left to accommodate the shoulder guard, and a smaller pocket at the right is drawn over the firing handle. Four straps on the underside of the cover secure it in position. Two buckles are sewed at the front end of the cover to engage the straps on the traveling muzzle cover.

The traveling muzzle cover closes the muzzle of the howitzer. The upper extremities of the cover fit into the gun slides of the cradle, and in removing the cover it should be drawn forward to the end of the slides to clean them. A metal handle is welded to the cover to assist in removing it. Two straps are provided which engage the buckles on the front end of the traveling breech cover and hold both covers in position longitudinally.

THE SHIELD.

The shield for the protection of the gunners is a hardened steel plate 0.15-inch thick, made in three parts—the apron, main shield, and top shield.

The main shield has a large opening through which the howitzer and cradle project, and smaller openings for the lines of sight. Its lower edge is attached to the front end of the trail by short shield angles and shield-support plates. Two steel angle shield stiffeners, riveted on the rear of the main shield to maintain its shape, are braced at the upper ends by tubular braces which extend to lugs on the axle arms. Additional diagonal shield braces extend from the same lugs and are attached to the main shield near the top carriage trunnions. The lower edge of the main shield extends slightly below the trail and is fitted with three hinges for the apron shield. A panoramic sight case for carrying the panoramic sight in traveling is attached to the left rear side of the main shield by means of the right and left bracket bases and bolts.

The top shield is hinged to the main shield and is arranged so as to fold back for traveling to an approximately horizontal position. It is fastened in the upright position by the top shield brace on either side extending from near its upper edge to the top shield brackets riveted on the main shield. In folding the top shield, the pins supporting the bracket ends of the top shield braces are removed, the shield laid back upon the bracket, thus locking the shield in the new position.

The apron extends to within 5 inches of the ground, and for traveling it is swung to the under-surface of the trail, where it is held by the two apron latches.

WHEELS.

The wheels are a modified form of the Archibald pattern, 60 inches in diameter and with 0.625-inch tires. The hub consists of a steel hub box and hub ring, the two having flanges which clamp the spokes and are drawn together by eight heavy bolts and a ring called a hub

band, which is threaded to the hub box. The lock washer and the wheel-hook bushing are located on the hub box between the hub band and the hub ring. The wheel-hook bushing is assembled under the wheel hook and by means of a flange secures the hook to the wheel. The wheel hook is used for attachment of ropes or chains in emergency traction. The lock washer is located between the wheel-hook bushing and the hub band and prevents the latter from unscrewing.

A removable bronze liner is forced into the hub box to form a wearing surface, and the outer end of the hub is closed by a bronze hub cap screwed on the hub box and locked with a small bolt called the hub-latch plunger, which is withdrawn and held in the disengaged position by the hub latch when the cap is to be unscrewed. The hub cap is also fitted with the standard wheel oil valve, which is pulled out to expose the opening for oiling the wheel and closes to render the hub dust proof.

The wheel fastening, a yoke of bronze, fitting recesses in the outer end of the axle arm, secures the wheel to the axle and is exposed when the hub cap is removed. The yoke is secured to the axle arm by the wheel-fastening plunger.

A description of one of the accessories follows:

Two loading handbarrows for transporting ammunition to the breech of the howitzer are supplied with each carriage. The barrow is made up of a flange steel tray, concave in section, riveted to handle supports having handles on either side for the servers. A breech-recess guide is riveted to the front end to support the tray in the breech recess of the howitzer while the projectile is being rammed into place. The barrows are carried, with the handles folded, on brackets riveted to the inside of the trail flasks and are secured by a pin passing through holes in the tray stop on the barrow and in the stop bearing riveted to the front transom.

DISMOUNTING AND ASSEMBLING HOWITZER AND CARRIAGE.

To dismount the howitzer.—Unscrew the cylinder-retaining ring on the rear end of the cylinder and draw the piece to the rear until the rails are free from the cradle gun slides.

To mount the howitzer.—Shove the piece from the rear, with the gun slides engaging the rails, guiding the cylinder carefully into the lug on the howitzer, taking care that the locating pin in the bore of the lug enters the notch cut on the exterior surface of the cylinder. Assemble the cylinder-retaining ring, locking it in place on the cylinder with the locking screw.

In moving the piece on or off the cradle particular care must be taken to support the breech end so that the howitzer rails are in prolongation of the cradle gun slides. The firing pallet is also exposed to injury during this maneuver, and care should be taken to prevent

it from being struck by the muzzle of the piece or by implements in the hands of cannoneers. The cradle should be placed at the desired elevation and azimuth before beginning either of these maneuvers and not changed during its progress, since the working of either of the elevating or traversing mechanisms when the piece is partially out of battery brings an excessive and unnecessary strain and wear upon the parts.

To dismount the cylinder.—The cradle should always be brought to zero elevation before the cylinder-retaining ring is removed. If the cylinder is to be dismounted without removing the howitzer, the howitzer should be securely lashed to the cradle to prevent movement to the rear. The piece having been brought to the horizontal position, the piston-rod nut is removed, the *four* swing-bolt nuts securing the cradle head are released and the cradle head removed. Only those swing bolts affecting the front cradle head are to be disturbed; the two securing the spring retainer are only to be loosened when the spring compressor is in place and when it is desired to remove the springs. The cylinder-retaining ring in rear of the howitzer lug is taken off, and the cylinder with piston rod, etc., withdrawn to the front.

To assemble the cylinder.—The springs, spring stirrup, and spring retainer, being in assembled position, shove the cylinder into its seat from the front, taking care that the locating pin in the bore of the lug of the howitzer enters the notch cut on the exterior surface of the cylinder. Screw in place the cylinder-retaining ring and secure it with the locking screw. Assemble the cradle head and screw in place the piston-rod nut.

In replacing the cylinder it sometimes happens that the inner springs have become displaced in a way to prevent the entrance of the cylinder; in such a case, reach in from the rear of the cradle and place the coil in its right location, either with the hand or a wooden stick.

To drain the cylinder.—Clean receptacles for holding 8 gallons of oil are to be provided. With the trail of the carriage limbered or supported on the trail prop, unscrew both drain plugs from the front cylinder head, and depress the cradle to its maximum. A duct should be improvised to lead the flow of oil beyond the muzzle, where it can be caught by the receptacles provided.

To fill the cylinder.—*Practically all damages to the rear cradle head and parts of cylinder can be traced to the fact that the cylinder was not completely filled with oil. For that reason the cylinder should be filled with the greatest care; a commissioned officer should himself verify that the cylinder is full and that no air is left in it, with the exception of the void noted below.*

The easiest way to fill the cylinder is to fill it when disassembled from the carriage. If this is impracticable, fill as follows: The piston rod, valve, counterrecoil buffer, and cylinder heads being assembled, the piston rod is drawn out until clear of the counterrecoil buffer, approximately 32 inches. With the cylinder assembled to the howitzer lug in such a location as to bring the filling and drain holes in a nearly vertical line, elevate the howitzer to maximum elevation.

Remove both plugs and fill slowly through either hole. When about two-thirds full, replace the plugs and depress to zero elevation to permit the air pocketed in the counterrecoil buffer recess to escape. The piston rod is now forced in to within an inch of its firing position. The cradle is again elevated, the cylinder entirely filled, and the rod forced in. Before final insertion of the plugs the valve should be rotated slowly to permit the escape of any entrapped air in the by-pass; also allow plenty of time for pocketed air to escape.

When satisfied that the cylinder is entirely full, allow about 10 cubic inches (about one-third pint) of oil to escape, this providing a void for the expansion of the oil. Tighten both plugs and secure them with copper wire.

It may happen that after firing a few rounds the howitzer will not return to battery. This may be due to, first, weakness of springs; second, stuffing-box gland being screwed up too tightly; or, third, the oil having expanded, due to heat.

In either case the cause must be ascertained and remedied; if due to expansion of oil, it is proven by the fact that the gun can not be pushed into battery by force exerted on the breech of the howitzer. In that case elevate to maximum elevation and remove the uppermost plug. The oil will now escape, permitting the howitzer to return to battery.

Approximately 62 pints of oil are required for filling the cylinder. Hydroline oil of a specific gravity of 0.85 is furnished by the Ordnance Department for use in these cylinders; it is characterized by its low freezing point and by its noncorrosive action on metals. The oil used in the cylinder is to be clean and free from grit and dirt; to insure this it is to be strained through a clean piece of linen or muslin before using.

In emergencies water may be used in the cylinder. This should be done only when absolutely necessary and never in freezing weather, and as soon as practicable the cylinder is to be emptied, cleaned, and thoroughly dried and filled with hydroline oil.

To dismount the springs.—The carriage should either be limbered or the trail supported in an approximately horizontal position by the trail prop or temporary blocking. With the cradle approximately level, remove the cylinder-retaining ring, screw the retracting eye into the threaded recess in the rear end of the counterrecoil

buffer. Hitch the trail chain securely around the lugs on the spade-key bracket on the end of the trail (spade removed), and attach the upper hook of the duplex block to it. By means of the retracting chain and the block put sufficient strain on the retracting eye to relieve the spring retainer from spring pressure. Remove the spring retainer and cradle head by loosening the swing bolts. Ease off the block until the springs are free.

On account of the great length of the free spring column, temporary blocking must be placed in front of and on line with the bottom of the cradle to support the weight of the cylinder, stirrup, and springs, both in releasing and in assembling the column.

To assemble the springs.—With the cradle approximately level and the trail up as directed for dismounting, shove the first section of the outer springs into the cradle until the front end has entered a few inches; set up a separator against the forward end of this section, keeping the separator upright between the sections; enter the second section and shove the column against the rear head of the cradle, setting up the second separator. Place the other two outer springs with the third separator on the spring stirrup and enter the rear end of the stirrup into the spring column in the cradle. Similarly assemble the springs of the inner column, two into the stirrup, two on the cylinder. Extend the duplex block as far as possible and, passing the end of the retracting chain through the spring column, engage it in the retracting eye screwed into the rear end of the counterrecoil buffer. The elevation of the cradle and the position of the supporting blocking should be such that when the chain is taut it will be in the center of the hole in the gun lug. While the spring column is being compressed, care must be taken to see that the feet on the stirrup outer rings enter the spring stirrup guides and that the rear ends of the cylinder and stirrup are properly guided through the rear head of the cradle. When the springs are sufficiently compressed, the spring retainer is assembled. The retracting chain can then be released and disengaged and the cylinder-retaining ring assembled.

As the spring columns are assembled under a load of 3,000 pounds, serious results may attend a sudden release by breakage of the chain or other part during the process of compressing; all parts should be carefully inspected before using, and all members of the gun crew be required to keep arms and bodies away from the front of the column during these operations.

To dismount the piston and piston rod.—The cylinder is removed from the cradle and drained. The gland lock is released and the gland slackened a few turns. Each carriage is furnished with two large wrenches, one of which fits the rear cylinder head and one the spring compressing ring; noting that the last named is locked by

the spring compressing ring lock, the rear cylinder head may be unscrewed and the piston and rod may be withdrawn from that end; or, the front cylinder-head spanner may be applied and that head removed, and the piston and rod taken out toward the front. If it be desired to dismount the valve the front cylinder head is taken off as the valve is removed at that end. If the piston only is to be removed it is best to break the joint in the cylinder exposed to the least internal pressure, i. e., that of the rear head. When either head of the cylinder is removed the opening is to be closed immediately by returning the head or by using clean cotton cloths to prevent grit from blowing into the valve and cylinder liner ports.

The cylinder liner screws into the cylinder from the front end and is locked by a plug at the rear end screwed through the cylinder wall. It is never to be disturbed outside of the machine shop, as each liner is forced in its seat and located individually by the lock, the notches in the rear of the cylinder being cut later to insure the exact position of the rows of cylinder liner ports in relation to the keys of the valve. Each cylinder, cylinder liner, and lock are therefore considered collectively as one interchangeable piece.

In dismounting and assembling the cylinder heads the cylinder is always to be held by the wrenches. It should never be held by clamping bars at its middle or by using a chain wrench, as its walls are thin and not intended to withstand such usage.

In assembling the valve in the cylinder liner it will be noted that the keys in the valve do not come to within 0.5 inch of one end; this is the forward end—the other enters the cylinder liner first. Before assembling the valve be perfectly sure that it is clean.

In assembling the piston rod the operations of dismounting are reversed. It ought *not* to be necessary to take out the stuffing-box packing.

The necessity for dismounting parts of the cylinder will seldom arise. It is to be done only in the presence of a commissioned officer, who will see that the parts are handled with the greatest care. In assembling the parts are to be thoroughly cleaned, as the clearances in the valve are very small and the presence of small foreign particles may interfere with the proper working of the parts.

To pack the stuffing box.—The stuffing box is packed with four rings of Garlock hydraulic waterproof packing 0.375 inch square, issued in rings cut to such size that the ends nearly meet around the rod. These rings are assembled in the cylinder, each ring being placed so as to break joints with the preceding one, and each in succession being forced into its seat by a packing tool of copper or hard wood; one end of this tool is shaped like a carpenter's gouge, while the other end is formed into a handle strong enough to withstand light taps from a hammer. Such a tool may be readily improvised

by the battery mechanic. After the four rings are firmly seated in the chamber the gland is screwed on.

Be sure that *at least eight* threads of the gland are engaged with the threads of the cylinder head, as otherwise the threads of the gland may be stripped in firing.

The adjustment of the gland will require the exercise of some judgment. If screwed up too tight the frictional resistance of the packing on the piston rod will be so increased that the counter-recoil springs may fail to return the howitzer to battery, especially at high angles of elevation, or the valve-turning mechanism may be strained. *It is to be screwed up just tight enough to prevent the leakage of oil.* Ordinarily this can be done by hand, but where hand power is not sufficient the wrench provided for the purpose should be used. When adjusted, the gland is to be locked.

To assemble and disassemble the valve-turning mechanism.—The valve gear sector assembled in the cradle head and the valve pinion sector are always to be engaged with their assembling marks coinciding. The seats for the valve gear sector and the shaft arm on the intermediate shaft are so arranged as to admit assembling in but one position, which arrangement, together with the assembling marks of the gears and the keying of the valve to the piston rod, insures the correct alignment of valve and cylinder liner. To remove the valve gear sector from the cradle head it is only necessary to dismount the latter and remove the gear retainer nut. The valve gear sector being disengaged, the valve pinion sector may be given a half turn, when its clip will be free from the cradle head.

A loose collar in rear of the shaft bearing (front) is secured to the intermediate shaft by a split pin; with this pin removed the shaft may be withdrawn forward. No instructions for dismounting or assembling other parts of the valve-turning gear should be required.

To dismount the quick-return mechanism.—The pinion-shaft nut and the four nuts securing the bearing retainer are removed and the intermediate gear and sleeve, clutch, washers, and spring, with the bearing retainer, may be withdrawn from the bearing case. Remove the gear cover and the nut on the lower end of the intermediate shaft. The shaft and the housing may now be removed through the bearing case, after which the pinion shaft may be unseated.

To assemble the quick-return mechanism.—The pinion shaft being assembled in the pinion-shaft bearing, seat the latter in the bearing case. With the intermediate shaft in its housing, the latter is assembled in the bearing case and top carriage right clip, at the same time placing the gear on its squared seat on the shaft and securing it with the intermediate shaft nut and split pin. On the pinion shaft placed in succession are the inner spring washer, the spring,

outer spring washer, intermediate gear sleeve, with the intermediate gear in place, and the pinion-shaft clutch. The bearing retainer is then assembled and secured with the four nuts, after which the pinion-shaft nut is assembled and the gear cover replaced.

To remove the shield.—First remove the bolts and nuts connecting the shield braces and lugs on the axle, the shield angles and trail, and the shield-support plates and the shield. The shield is then free to be moved to the front. The apron may be removed before the shield braces are loosened to facilitate handling.

To dismount the cradle.—The howitzer, shield, and quick-return pinion are dismounted, the valve link disconnected from the left trunnion cap, the trunnion-cap swing bolts loosened, and the caps swung open; the cradle and rockers may now be lifted free from the top carriage toward the rear.

To dismount the elevating mechanism.—Note that the worms can not be assembled or disassembled while the rockers are engaged. With the howitzer dismounted it is possible to depress the cradle sufficiently to disengage the rockers from the worms, but in dismounting the worms it will generally be preferable to dismount the cradle first. The right worm bearing cap may then be removed and the right worm dismounted. The elevating-gear cover and the nut from the left end of the elevating shaft are removed, the right bearing bushing unbolted, and the elevating shaft withdrawn through the right side plate. The left worm bearing cap may now be removed and the worm dismounted. To remove the handwheel shaft, the nut in front of the bevel pinion is removed and the shaft withdrawn through the bearing on the rear clip.

To assemble the elevating mechanism.—Note that both rockers must elevate simultaneously, and to do so the following points are observed in the manufacture: The threads on the worms are in exactly the same relative position; the flat faces of the squared end of the worms are located in fixed relation to the thread; the teeth of the gears are cut in exact location with respect to the squared hole, and the teeth of the elevating-shaft pinions are located exactly alike. To assure the proper assembly of the worms, the thrust washers on the rear of the worms have cut upon them assembling marks which should coincide simultaneously with the dividing lines between their respective worm bearings and caps.

To assemble, reverse the order of dismounting. The handwheel shaft collar is placed in the half bearing of the elevating-gear case (shoulder to the rear) and the handwheel shaft and pinion assembled. The left worm and gear are next assembled in the worm bearing and the intermediate worm shaft replaced, adjusting as it enters, the collar on the inside of the left elevating bearing. The right bearing bushing is restored, and the right worm, gear, and cap assembled.

To dismount the traversing mechanism.—Remove the traversing nut dust guard, and the traversing-screw washer and nut, from the inner side. The handwheel is then taken off, the locking screw taken out, the thrust-bearing nut unscrewed, and the ball-thrust bearing removed; the traversing screw is then unscrewed and withdrawn through the traversing pivot. No special instructions are required for removing the balance of the mechanism. In reassembling the thrust-bearing nut must *not* be tightened enough to clamp the ball-thrust bearing.

To dismount the firing mechanism.—No special instructions should be required. Withdrawing the taper pin securing the collar on the forward end of each shaft allows the shaft to be withdrawn to the rear. In assembling, tension is put upon the springs as the firing-handle hub is assembled.

To dismount the top carriage.—The howitzer, shields, cradle, and traversing mechanism are dismounted and the front clip of the trail is removed. The top carriage may then be traversed to the left until free from the clips.

To remove a wheel.—Support the axle to bring the wheel clear of the ground. Lift up the flap of the hub latch, thus disengaging its bolt, and unscrew the hub cap; the wheel fastening, which is now exposed, is secured to the axle by a spring pin in one side; when this is pressed back, the wheel fastening may be lifted free and the wheel slipped off.

To remove a hub liner.—Take the wheel from the axle and drive the liner out by striking with a heavy hammer or sledge upon a suitable wooden or metal block placed against the small end of the liner. A hub-liner driving tool is carried in the forge limber for this purpose. In assembling a new liner be sure the surfaces are perfectly clean and that no dust gets under the flange of the liner to prevent it being driven solidly against the face of the hub. Unless the liner is forced completely into the hub the distance from the face of the liner to the small end of the hub may be too great to allow the assemblage of the wheel fastening. Should the outer end of the liner project beyond the small end of the hub, it may be filed flush.

The parts of this carriage in general are made with sufficient clearance to permit the assemblage of any part without the use of force. In assembling them no part should be directly struck with a hammer. If resort to force is necessary, a piece of wood or copper drift should be interposed between the hammer and the part struck. Most of the nuts and pins are provided with split pins as keepers. The split pins must, of course, be removed to remove the nut, and when the nut or pin is assembled the split pin should be inserted and properly opened.

CARE AND CLEANING OF RECOIL CYLINDER AND OTHER PARTS OF THE CARRIAGE.

The carriage is a machine for controlling the recoil of the howitzer and should be properly cleaned and cared for to insure its working correctly. The officers responsible for the efficiency of the battery should familiarize themselves with the carriage mechanism and with the foregoing instructions as to the methods of mounting and dismounting the various parts and should see that the carriage is properly handled, cleaned, and cared for. The following general directions for its care and cleaning are given.

The recoil cylinder should be emptied and refilled once every three months. The piston and valve should be examined every six months (or oftener if conditions require it) for rubbing or scoring of the inside of the valve or piston. If such roughening be noted, the roughness is to be carefully smoothed down by a skilled workman with a dead smooth file or with fine emery cloth; the cause of the roughness should be ascertained and removed. To prevent chips and emery from entering the cylinder liner ports, work on the valve should always be done with the valve removed from the liner. When unusual rubbing or scoring has occurred, the facts will be reported to the officer of the Ordnance Department charged with the duty of keeping the battery in repair for his information and action. Before reassembling the valve, liner, piston, counterrecoil buffer, and the tuffing box should be thoroughly cleaned by the use of cotton cloths and coal oil and wiped dry. The use of cotton waste, especially in the cylinder liner, is not recommended, as particles of waste will work into the ports. The removal of the packing is not necessary in cleaning the stuffing box.

The parts are to be reassembled immediately after their cleaning and inspection and the cylinder filled with the hydroline oil issued for that purpose. The piston should be moved back and forth and rotated in the cylinder by hand to make sure that all parts are correctly assembled and without interference. After the cylinder is mounted in the cradle, the howitzer should be pulled from battery by means of the 2-ton chain block and permitted to counterrecoil rapidly to insure that all parts are in proper position for firing. *This should never be done, however, unless the cylinder is known to be filled with oil.* In reassembling the parts the condition of the fiber washers between cylinder heads and cylinder should be noted; they should be replaced whenever necessary.

In removing and inserting the piston rod, care should be taken to keep it central in the cylinder, so as not to bind, burr, or spring any parts. The dismounting and reassembling of the parts of the cylinder should in every case be supervised by a commissioned

officer. Before firing, an inspection should be made to ascertain that the different parts, especially the piston rod and nut, are correctly assembled.

The recoil-cylinder oil should be stored in the closed cans provided for the purpose, and be carefully protected from dirt, sand, or water. Oil withdrawn from cylinders and containing any sediment must not be used again for any purpose until it has been allowed to settle for not less than 24 hours. When sediment has thus been permitted to settle, great care must be taken not to disturb it in removing the oil. To insure the cleanliness of all cylinder oil it should be strained through a clean piece of linen or muslin before using.

The counterrecoil springs should be dismounted at least once every six months and be thoroughly cleaned. All rust should be removed and the springs well oiled before assemblage. When the springs are dismounted the interior of the cradle should be cleaned and examined for defective riveting, missing rivet heads, and scoring. The stirrup should be carefully examined for bulged or cracked ends, and all burrs or scores on the bronze heads carefully smoothed off.

The gun slides should be kept well cleaned and lubricated. The operation of cleaning the slides is as follows: First clean those parts of the howitzer guides projecting in front of the cradle. Remove the cylinder locking screw and cylinder retaining ring, and with the aid of the retracting chain and maneuvering bar, as described under the traveling locks, pull the howitzer back a sufficient distance to permit inserting the arm between the howitzer lug and the rear of the cradle, and clean the parts of the gun slides thus exposed. The howitzer should then be pulled back to the extreme position with the lug resting on the ways of the cleaning track. When in this position the howitzer guides will still have a bearing of 5 inches in the gun slides, thus supporting the muzzle end of the howitzer. The slides should be well oiled before the howitzer is returned into battery. Before beginning to fire, the gun slides should always be oiled through the oil holes on the sides of the cradle. Lack of proper lubrication of the gun slides is the most frequent cause of failure to return fully into battery.

In traveling the howitzer should be locked to the trail by means of the rear traveling lock, so as to relieve the pointing mechanisms of all travel stresses. After the howitzer is so locked the pawls should be released and the rockers elevated until the pawls are clear.

The wheels and wheel fastenings should be dismounted periodically and the fastenings, hub boxes, axle arms, and axle bore cleaned and examined. All roughness due to scoring or cutting should be smoothed off. In oiling the wheels in service, a small quantity

(about 1 gill) of lubricating oil should be placed in the axle bore through the oil valve in the hub cap. A short experience will enable the battery commander to determine how often the wheels should be oiled.

The nuts on the hub bolts should be tightened monthly the first year of service and twice a year thereafter. The ends of the bolts should be lightly riveted over to prevent the nut from unscrewing. When the hub bolts are tightened, the hub band should be screwed up as tightly as possible against the lock washer at the outer end of the wheel-hook bushing.

The wooden parts of the wheels are made of thoroughly seasoned materials, and the hub bolts and bands, when the wheels are issued, are properly tightened; but all wood is susceptible to change with atmospheric conditions, so that the spokes speedily become loose, and if a wheel is used in this condition it will rapidly be made un-serviceable, and may be damaged beyond repair.

The importance of strict compliance with these rules can not be overestimated.

THE 6-INCH HOWITZER CARRIAGE, MODEL OF 1908 MI.

(Class IV, section 3.)

WEIGHTS, PRINCIPAL DIMENSIONS, ETC.

Weight of carriage, complete.....	pounds..	5,671
Weight of howitzer and carriage, complete.....	do....	7,582
Weight at lunette, carriage limbered and howitzer in battery.....	do....	550
Weight at lunette, carriage limbered and howitzer in traveling position..	do....	1,371
Diameter of wheels.....	inches..	60
Width of track.....	do....	60
Maximum angle of elevation.....	degrees..	40
Maximum angle of depression.....	do....	5
Amount of traverse of howitzer on carriage.....	millièmes..	107
Length of recoil of howitzer on carriage, howitzer at zero degrees elevation.....	inches..	63
Length of recoil of howitzer on carriage, howitzer at 40° elevation....	do....	26
Height of axis of howitzer.....	do....	43
Height of line of peep sight.....	do....	51
Length of sight radius.....	do....	19

Nomenclature of parts of carriage.

Number.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Apron latches, complete.....	See nomenclature of parts of 6-inch howitzer carriage, model of 1908.....		
	Brake mechanism.....	do.....		
1	Cradle, complete, including—			
1	Bushing.....	In front cradle head.....		
1	Do.....	In rear cradle head.....		
2	Bushings.....	Forced on trunnions.....		
1	Connecting rod bearing, front.....	Bearing for middle connecting rod of valve turning gear.....		
1	Connecting rod bearing, rear.....	do.....		
2	Connecting rod guides.....	Riveted on right side of cradle bottom plate.....		
1	Cradle bottom plate.....	Forms bottom of cradle.....		
2	Cradle head side clips.....	Riveted on front end of cradle plate.....		
2	Cradle head top clips.....	do.....		
1	Cradle plate.....	Forms hood over recoiling parts.....		
2	Cradle plate angles.....	Reinforce rear end of cradle plate.....		
1	Front cradle head.....	At front end of cradle.....		
1	Gun slide, left.....	Riveted in cradle bottom plate.....		
1	Gun slide, right.....	do.....		
1	Patent plate.....	Screwed on left side of plate.....		
1	Pawl bearing, left.....	Riveted to cradle plate.....		
2	Pawl bearing, right.....	do.....		
2	Rack bolts.....	Fasten quick-release rack to trunnion.....		
1	Rack studs.....	Screwed into right trunnion.....		
1	Rear cradle head.....	Riveted to rear of cradle plate.....		
1	Shoulder guard.....	Riveted to left side of cradle plate.....		
1	Spring retainer.....	At front end of cradle.....		
2	Spring-retainer clips.....	Riveted on front end of cradle plate.....		
1	Spring stirrup guide, left.....	Riveted to cradle-bottom plate.....		
1	Spring stirrup guide, right.....	do.....		
6	Swing bolts.....	In cradle head side clips, top clips, and spring-retainer clips.....		
1	Thrust bearing.....	Riveted to inside of front cradle head.....		
1	Trunnion, left.....	Riveted to cradle plate.....		
1	Trunnion, right.....	do.....		
	Elevating mechanism.....	See nomenclature of parts of 6-inch howitzer carriage, model of 1908.....		
	Firing mechanism.....	do.....		
	Front traveling lock.....	do.....		
	Handspikes.....	do.....		
	Quick-return mechanism, consisting of—			
2	Bushings.....	In right and left pawls.....		
1	Gear-case cover.....	Bolted to quick-return gear case.....		
1	Intermediate shaft.....	In quick-return gear case.....		
1	Pawl, left.....	On pawl shaft.....		
1	Pawl, right.....	do.....		
1	Pawl handle.....	Riveted to right pawl.....		
2	Pawl plungers.....	In pawls.....		
1	Pawl shaft.....	Connects pawls through cradle.....		
2	Pawl springs.....	On pawl plungers.....		
1	Quick-return gear.....	On intermediate shaft.....		
1	Quick-return handwheel.....	See nomenclature of parts of 6-inch howitzer carriage, model of 1908.....		
1	Quick-return pinion.....	In quick-return gear case with extension for handwheel.....		
1	Quick-return segment.....	Bolted to right trunnion.....		
1	Safety latch.....	Finned to safety-latch bearing.....		
1	Safety-latch bearing.....	Riveted to right pawl bearing.....		
1	Safety-latch plunger.....	In safety-latch bearing.....		
1	Safety-latch spring.....	On safety-latch plunger.....		
1	Washer.....	On pawl shaft.....		
1	Washer.....	On safety-latch bearing.....		
	Rear traveling lock.....	See nomenclature of parts of 6-inch howitzer carriage, model of 1908.....		
	Recoil and counter-recoil arrangement.....	See nomenclature of parts of 6-inch howitzer carriage, model of 1908, except valve-turning gear.....		
1	Valve-turning gear, consisting of—			
1	Connecting-rod nut.....	On connecting-rod pin, rear.....		
1	Connecting-rod pin, front.....	In valve turning gear and front connecting rod.....		
1	Connecting-rod pin, middle.....	In front and middle connecting rods.....		
1	Connecting-rod pin, rear.....	In rear connecting rod and right trunnion.....		
1	Front connecting rod.....	Connects valve turning gear and middle connecting rod.....		

Nomenclature of parts of carriage—Continued.

Number.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
	Recoil and counter-recoil arrangement—Continued,			
	Valve-turning gear, consisting of—Continued.			
1	Middle connecting rod.....	Connects front and rear connecting rods...		
1	Rear connecting rod.....	Connects middle connecting rod and trunnion cap.		
1	Slide.....	On connecting-rod pin, rear.		
1	Valve-turning gear.....	In front cradle head.		
1	Valve turning pinion.....	Keved to piston rod.		
1	Washer.....	Under nut on valve turning gear.		
	Shields.....	See nomenclature of parts of 6 inch howitzer carriage, model of 1908.		
	Sighting arrangement.....	Safety depression stops not used with shield		
	Spade.....	See nomenclature of parts of 6-inch howitzer carriage, model of 1908.		
	Top carriage complete, consisting of—	See nomenclature of parts of 6-inch howitzer matériel, model of 1908.		
1	Bottom plate bushing.....	Riveted to top carriage bottom plate....		
1	Depression stop.....	do.....		
1	Elevating bearing, left.....	Inside of side plate.....		
1	Elevating bearing, right.....	Inside of side plate.....		
1	Elevating gear case.....	Riveted to top carriage side plate, left.....		
1	Elevating gear cover.....	Bolted to elevating gear case.....		
2	Elevating worm bearings.....	Riveted to top carriage bottom plate.....		
1	Filler ring.....	do.....		
1	Inner plate, left.....	Reinforces side plate inside.....		
1	Inner plate, right.....	do.....		
1	Quick-return gear case.....	Riveted to top carriage side plate, right.....		
1	Sight fastening.....	Bolted to trunnion bearing, left.....		
2	Sight fastening studs.....	Screwed into trunnion bearing, left.....		
1	Top carriage bearing plate, left.....	Riveted to top carriage bottom plate.....		
1	Top carriage bearing plate, right.....	do.....		
1	Top carriage bottom plate.....	Riveted to top carriage side plates.....		
1	Top carriage front clip.....	Riveted to top carriage bottom plate.....		
1	Top carriage left clip.....	On rear end of side plate, left.....		
1	Top carriage right clip.....	On rear end of side plate, right.....		
1	Top carriage side plate, left.....	Riveted to top carriage bottom plate.....		
1	Top carriage side plate, right.....	do.....		
1	Trunnion bearing, left.....	Riveted to top carriage side plate, left.....		
1	Trunnion bearing, right.....	Riveted to top carriage side plate, right.....		
1	Trunnion cap, left.....	On trunnion bearing, left.....		
1	Trunnion cap, right.....	On trunnion bearing, right.....		
4	Trunnion cap pins.....	In trunnion bearings and caps.....		
2	Trunnion cap swing bolts.....	In trunnion caps.....		
2	Worm bearing caps.....	Bolted to elevating worm bearings.....		
	Trail.....	See nomenclature of parts of 6-inch howitzer carriage, model of 1908.		
	Trail prop.....	do.....		
	Traversing mechanism.....	do.....		
	Wheels, 60-inch.....	do.....		
	Wheel fastenings.....	do.....		

IV

3

DESCRIPTION OF THE CARRIAGE.

The 6-inch howitzer carriage, model of 1908 MI, is similar to the 6-inch howitzer carriage, model of 1908, and many of the parts of the two carriages are identical and interchangeable. A number of minor changes and improvements have been made, as hereafter described.

THE CRADLE.

The right trunnion and cradle plate are slotted to allow for the movement of the rear connecting-rod pin of the valve-turning mechanism. The outer counterrecoil spring column is of slightly larger diameter, and the dimensions of the cradle plate, cradle heads, recoil-controlling parts, etc., are changed to correspond.

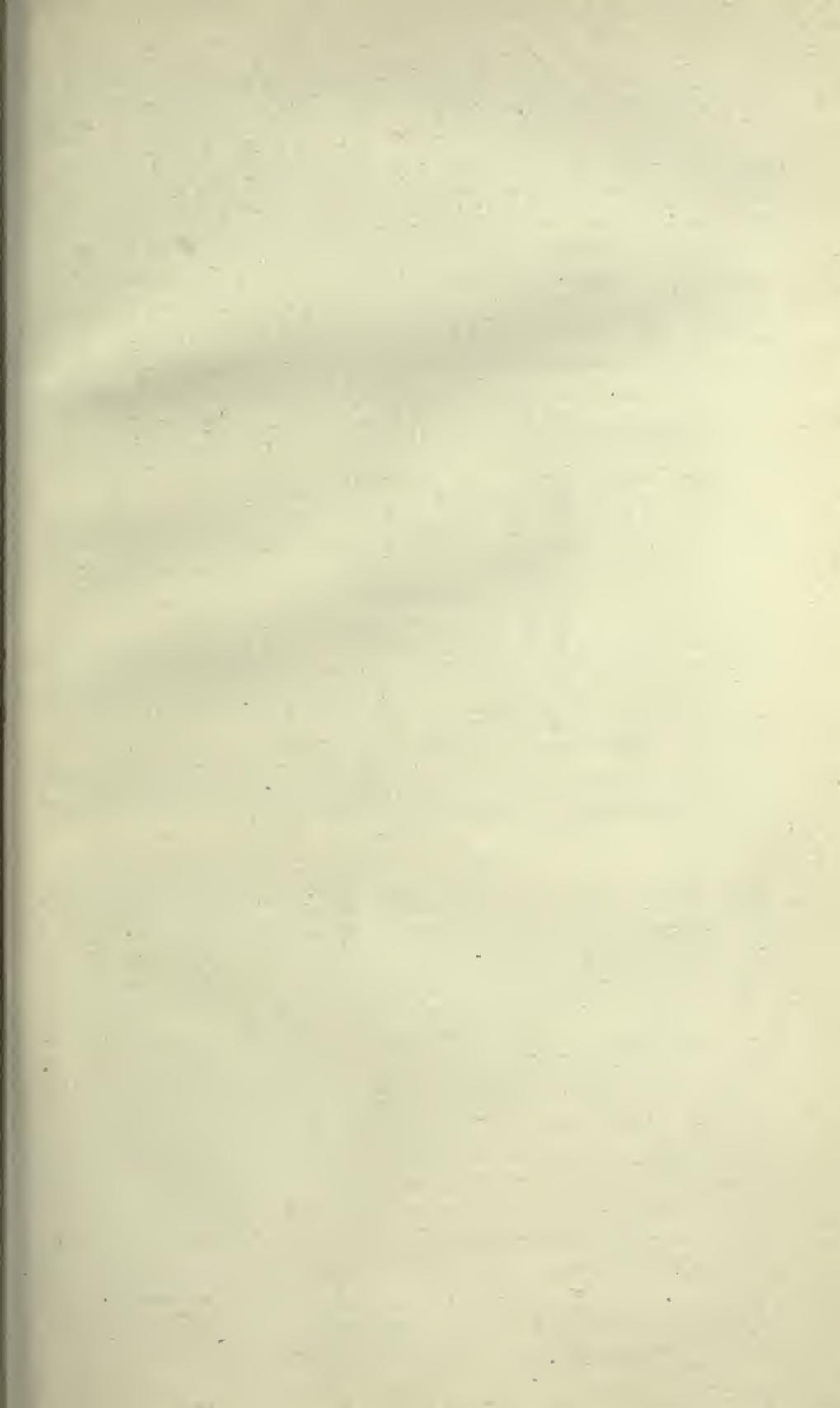
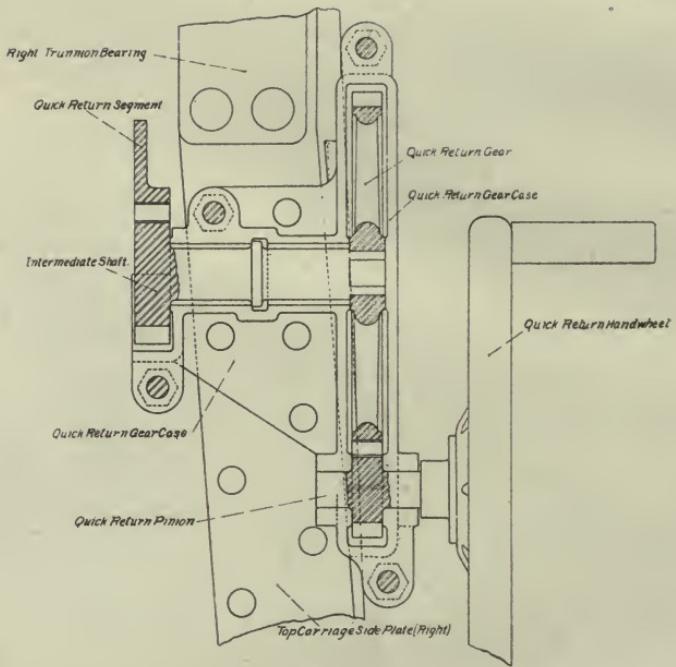


Plate XI



Quick Return Mechanism.
Section

(For Carriage Model O' 1908 MU)

The valve-turning mechanism consists of the valve-turning pinion, the valve-turning gear, the connecting rod, and the connecting-rod pins.

The hub of the valve-turning pinion fits into the bearing formed by the bore in the front cradle head and meshes with the valve-turning gear, also located in a bearing in the front cradle head. An arm on the valve-turning gear is pinned to the connecting rod which slides between the right spring stirrup guide and connecting-rod bearings bolted in the upper flange of the cradle bottom plate. The connecting rod is in three parts, connected by the connecting-rod pins. The rear connecting-rod pin projects through the side of the cradle and flange of the trunnion and engages the lug on the right trunnion cap. A bronze slide on the rear connecting-rod pin works in a groove in the cradle plate.

ACTION OF THE MECHANISM DURING RECOIL.

The action of the mechanism during recoil is the same as on the 1908 carriage.

THE TOP CARRIAGE.

The top carriage is built in the same manner as the 1908 carriage, except that the quick-return gear case riveted to the right side plate is different, as hereafter described.

THE ELEVATING MECHANISM.

The elevating mechanism is the same as on the 1908 carriage, and all parts for both carriages are identical and interchangeable.

THE QUICK-RETURN MECHANISM.

The quick-return mechanism consists of the quick-return gear, the quick-return pinion, the quick-return segment, quick-return gear case and cover, handwheel, pawls, and accompanying parts of each.

The pawls with their accompanying parts are identical and interchangeable with those on the 1908 carriage.

The quick-return gear case is riveted to the top-carriage side plate, right, and with the gear-case cover completely incloses the gears of the quick-return mechanism. The intermediate shaft has a pinion cut on its inner end which meshes with the quick-return segment bolted to the right trunnion. A collar formed on the intermediate shaft fits in a groove in the bearing of the gear case and prevents axial movement of the shaft. The quick-return gear is fitted on the squared outer end of the intermediate shaft and meshes with the quick-return pinion. The quick-return handwheel is located on the end of the quick-return pinion.

When the pawls are disengaged, one revolution of the quick-return handwheel elevates or depresses the cradle about 9.6° .

As will be seen from the above, by elevating or depressing the rocker the gears and handwheel of the quick-return mechanism will be actuated also, while by turning the quick-return handwheel only the cradle and quick-return gears move.

SAFETY FIRING DEVICE.

The safety firing device is the same as used on the 1908 carriage, and all parts for both carriages are identical and interchangeable.

THE TRAIL.

The trail is the same as that used on the 1908 carriage, and all parts for both carriages are identical and interchangeable, with the exception of the axle and the sight packing.

The axle is made in two parts, each part being forged from a single piece of steel. Each half of the axle is flanged, and rivets through these flanges and corresponding flanges on the pintle plate connect them to the flasks. The coupling nut with right and left hand threads joins the parts of the axle. Both the body and the arm of each part of the axle are bored out to reduce weight; the bore in the arm being closed at the inner end by the axle-arm plug. The space thus created is used as a reservoir for lubricating oil.

The sight packing in the trail is designed to accommodate the model of 1912 sight, and the cover, bottom plate, and front transom are drilled to correspond.

THE TRAVERSING MECHANISM.

The traversing mechanism is the same as used on the 1908 carriage, and all parts for both carriages are identical and interchangeable.

THE ROAD BRAKE.

The road brake is the same as now used on the 1908 carriage, and all parts for both carriages are identical and interchangeable.

THE TRAVELING LOCKS.

The traveling locks are the same as used on the 1908 carriage and all parts for both carriages are identical and interchangeable.

THE TRAVELING COVERS.

The traveling breech cover and the traveling muzzle cover are identical and interchangeable with those used on the 1908 carriage.

THE SHIELD.

The shield is the same as used on the 1908 carriage and all parts for both carriages, except the main shield plates, are identical and interchangeable.

The large opening in the main shield is cut to accommodate the large cradle, and projections into the openings serve the purpose of the safety-depression stops used on the 1908 carriage.

THE WHEELS.

The wheels and wheel fastenings are the same as and interchangeable with those on the 1908 carriage.

The loading handbarrows are also the same as those used with the 1908 carriage.

DISMOUNTING AND ASSEMBLING HOWITZER AND CARRIAGE.

The instructions for dismounting and assembling the 1908 howitzer and carriage apply also to the model of 1908 M1, except in the case of the valve-turning mechanism, the quick-return mechanism, and the cradle.

To assemble and dismount the valve-turning mechanism.—The valve-turning gear assembled in the cradle head and the valve-turning pinion are always to be engaged with their assembling marks coinciding. The seat for the valve-turning pinion on the piston rod is so arranged as to admit assembling in but one position, which, together with the assembling marks on the gear and pinion and the keying of the valve to the piston rod, insures the correct alignment of valve and cylinder liner. In dismounting, the split pin in the rear connecting-rod pin is removed and the pin taken out. The four swing bolts holding the front cradle head are released and the cradle head removed just far enough to disconnect the valve-turning gear from the connecting rod. In reassembling, the connecting rod should be pulled out far enough to pin it to the arm of the valve-turning gear. The rear connecting-rod pin is assembled in place by elevating or depressing the cradle.

No special instructions are necessary for the dismounting and assembling of the quick-return mechanism. All the parts are readily accessible after the gear-case cover is removed.

In dismounting the cradle, the parts are lifted free from the top carriage toward the front.

THE 4.7-INCH GUN AND 6-INCH HOWITZER LIMBER, MODEL OF 1905.

[This limber is common to the 4.7-inch gun and 6-inch howitzer batteries.]

WEIGHTS, DIMENSIONS, ETC.

Weight, complete, including spare connecting pole.....	pounds..	1,545
Weight, with 6-inch howitzer and carriage, model of 1908.....	do....	8,900
Weight, with 6-inch howitzer and carriage, model of 1908 M1.....	do....	9,127
Diameter of wheels.....	inches..	50
Width of track.....	do....	60
Free height under limber and carriage.....	do....	16.5
Turning angle with 6-inch howitzer carriage.....	degrees..	39

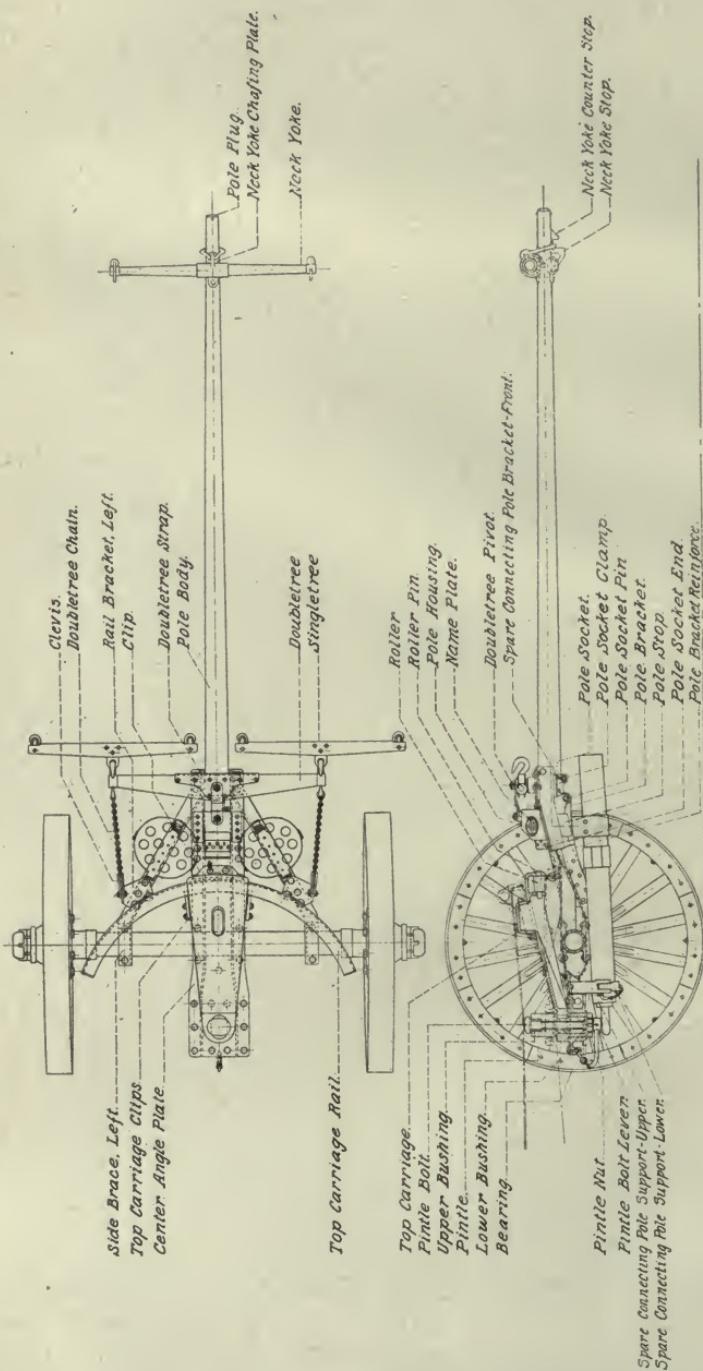
Nomenclature of parts.

Number.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Axle.....	Riveted to side braces.....		
2	Bucket holders.....	In strap fasteners.....		
4	Bucket straps.....	Riveted to bucket holders.....		
8	Bucket strap fasteners, style No. 1.....	Under axle.....		
1	Center angle, left.....	d ⁿ		
1	Center angle, right.....	Over axle.....		
1	Center angle plate.....	Braces top carriage rail at center.....		
1	Clip.....			
1	Doub'tree, complete, consisting of—			
1	Doub'tree body.....	At ends of doubletree.....		
2	Double hooks.....	Through center of doubletree.....		
1	Nipple.....	On nipple.....		
1	Nipple nut.....	Ar'und nipple.....		
1	Nipple separator.....	Reinfor es middle of doubletree.....		
1	Reinforce pie.e.....	Around rivets.....		
11	Separators.....			
2	Doub'tree chains, complete, consisting of—			
2	Chains.....	Limit movement cf doubletree.....		
2	Clevises.....	Bolted to rail brackets.....		
2	End links.....	Loop over double hooks.....		
1	Doubletree pivot.....	In pivot strap.....		
1	Doubletree pivot strap.....	Bearing for doubletree.....		
1	Doubletree strap.....	Bolted to pole housing.....		
1	Eye rivet.....	On underside of pintle bearing.....		
1	Name plate.....	On right side of pole housing.....		
1	Neck yoke, complete, consisting of—			
1	Neck-yoke body.....	Around middle of body.....		
1	Center eye sleeve.....	Riveted on ends of body.....		
2	End eye sleeves.....	Through end eye sleeves.....		
2	Eye rings.....	In eye rings.....		
2	Eye-ring loops.....	On eye-ring loops.....		
2	Loop sleeves.....	Through neck-yoke body.....		
2	Martingale staples.....	In center eye sleeve.....		
1	Pole ring.....			
1	Pintle, complete, consisting of—			
1	Pintle.....	Through pintle bearing.....		
1	Lower bushing.....	In lower end of pintle.....		
1	Key.....	In side of pintle.....		
1	Pintle nut.....	On lower end of pintle.....		
1	Upper bushing.....	In upper end of pintle.....		
1	Pintle bearing.....	Riveted to rear ends of center angles and center-angle plate.....		
1	Pintle bolt, complete, consisting of—			
1	Pintle bolt.....	Through pintle.....		
1	Pintle-bolt lever.....	On lower end of pintle bolt.....		
1	Bolt snap.....	Snaps into eye rivet.....		
1	Chain.....	Holds pintle bolt in locked position.....		
1	Ring.....	Through hole in end of pintle-bolt lever.....		
1	Pole, complete, consisting of—			
1	Pole body.....	In side of body.....		
1	Pole-pin bushing.....	Riveted in front end of pole.....		
1	Pole plug.....	Riveted in rear end of pole.....		
1	Butt reinforce.....	Riveted to upper side of body.....		
1	Neck-yoke chafing plate.....	Hinges on counter stop pin.....		
1	Neck-yoke counter stop.....	Riveted in pole body.....		
1	Neck-yoke counter stop pin.....	Bears on neck-yoke counter stop.....		
1	Neck-yoke counter stop spring.....	Riveted in body.....		
1	Neck-yoke stop.....			
1	Pole bracket, left.....	Support pole socket.....		
1	Pole bracket, right.....	Riveted to pole bracket, left.....		
1	Pole bracket reinforce, left.....	Riveted to pole bracket, right.....		
1	Pole bracket reinforce, right.....	Over rear of pole socket.....		
1	Pole housing.....	Secures pole in socket.....		
1	Pole pln.....	Riveted to side brace, left.....		
1	Pole-prop pocket.....	do.....		
1	Pole-prop support.....	In strap fasteners.....		
1	Pole-prop strap.....	Riveted to side brace, left.....		
2	Pole-prop strap fasteners, style No. 2.....	Hinges in pole brackets.....		
1	Pole socket, complete.....			
	Consisting of—			
1	Pole socket body.....	Riveted to pole-socket body.....		
1	Pole socket clamp.....	Over end of pole-socket body.....		
1	Pole socket end.....	Riveted to top of pole-socket body.....		
1	Pole socket reinforce.....			

IV

* The components are for steel pole, which will be issued to replace the wooden pole when the latter becomes unserviceable and the present supply of wooden poles is exhausted.

6311—17——7



4.7-Inch Gun and 6-Inch Howitzer Limber, Model of 1905.

Scale

Nomenclature of parts—Continued.

Number.	Name of part.	Location, etc.	Property classification.	
			Class.	Section.
1	Pole stop.....	Under rear of pole socket.		
1	Rail bracket, left.....	Brace top carriage rail at sides.		
1	Rail bracket, right.....	do.....		
1	Side brace, left.....			
1	Side brace, right.....			
2	Singletrees, complete.....	Attached to doubletree.....		
	Consisting of—			
2	Singletree bodies.....	In middle of singletree.....		
2	Singletree eyes.....	At ends of singletree.....		
4	Singletree hooks.....	Riveted to center angles.....		
1	Spare connecting-pole bracket (front).....	Riveted to spare connecting-pole bracket (front).		
1	Spare connecting-pole bracket (front).....			
	upper strap.			
1	Spare connecting-pole support, complete, consisting of—	Hinged to spare connecting-pole support (upper).		
1	Spare connecting-pole support (lower).	Locks pole support (lower) in position.		
1	Spare connecting-pole support pin.	In end of connecting-pole support pin.		
1	Chain, with bolt snap and two rings.			
1	Chain rivet.....	In pole support (lower).....		
1	Top carriage, complete, consisting of—			
1	Top carriage.....	Turns in pintle bearing.....		
2	Top-carriage clips.....	Bolted to top carriage.....		
3	Rollers.....	On roller pins.....		
3	Roller pins.....	Pinned in top carriage.....		
1	Top-carriage rail.....	Bearing for top-carriage rollers.....		
2	Wheels, 50-inch, complete, consisting of—			
16	Carriage bolts and nuts.....	Through hub box and spokes.....		
16	Dowels.....	In ends of felloe segments.....		
64	Felloe rivets and washers.....	Through felloe segments.....		
16	Felloe segments.....			
2	Hub bands.....	Screwed on hub boxes.....		
2	Hub boxes.....			
2	Hub caps.....	On ends of hub boxes.....		
2	Hub latches.....	Actuate hub-latch plungers.....		
2	Hub latch pins.....	'In hub latches to plungers.....		
2	Hub latch plungers.....	Lock hub caps in place.....		
2	Hub latch springs.....	On hub-latch plungers.....		
2	Hub liners.....	Forced into hub boxes.....		
2	Hub rings.....	Outer flanges of wheel hubs.....		
2	Lock washers.....	Between hub bands and hub rings.....		
2	Oil valves.....	Slide in hub caps.....		
2	Oil-valve springs.....	Around oil valves.....		
2	Oil-valve washers.....	On inner ends of oil valves.....		
32	Spokes.....			
2	Tires.....			
16	Tire bolts with nuts and washers.....	Through tires and felloe segments.....		
2	Wheel hooks.....	On outside of hubs.....		
2	Wheel-hook bushings.....	Bearings for wheel hooks.....		
2	Wheel fastenings, complete, consisting of—			
2	Wheel fastenings.....	On ends of axle.....		
2	Wheel fastening plugs.....	In wheel fastenings.....		
2	Wheel fastening plungers.....	Hold wheel fastenings in place.....		
2	Wheel fastening springs.....	Actuate wheel fastening plungers.....		

DESCRIPTION OF THE 4.7-INCH GUN AND 6-INCH HOWITZER LIMBER MODEL OF 1905.

(Plate XII.)

The carriage limber is designed to afford the usual arrangement for the attachment of the team and to support the trail in traveling. Motor traction may also be employed by substituting a short connecting pole for the regular limber pole. The principal parts are the wheels, axle, frame, top carriage, pole socket, pole, doubletree,

singletrees, and neck yoke. The limber is made of metal throughout, wood being used only in the spokes and felloes of the wheels.

The top carriage is formed for use with the trails of either the 4.7-inch gun carriage, model of 1906, or the 6-inch howitzer carriage. The trail of the carriage rests on the top carriage of the limber. When the limber is turning a corner the top carriage revolves about the pintle center, rolling on the top-carriage rail of the limber frame.

A wide flange steel center angle plate is riveted to the axle as a middle rail, and with the braces of heavy steel angles underneath and at the sides forms a trussed frame for the vehicle. Sixteen inches to the rear of the axle a bronze bearing for the pintle is solidly riveted between the rear ends of the center angle plate and center angles. Forward, these converge with the side braces and form a yoke in which the pole socket may oscillate in a vertical plane. The front ends of this yoke are connected by the riveted doubletree pivot strap. A seat for the doubletree is formed on the top of the doubletree pivot strap; the doubletree pivot is screwed into this seat and projects up through the doubletree; its upper end is threaded for a crown nut and is braced back to the pole housing, a flange steel part which constrains the pole socket in its vertical plane and limits the upward movement of its rear end. The pole socket is of flange steel with its forward end split and furnished with a clamp bolt for drawing firmly about the pole.

The pole pin passes through pole brackets and pole bracket reinforces, riveted on each side of the yoke, and the clamp forging of the socket, securing the socket to the frame. Between the pole housing and the pole stop the socket may swing through an angle of about 31° with the socket pin as an axis. This pivoting of the pole is necessary, as the entire limber body rotates about the axle in passing over uneven ground.

The top-carriage rail is a steel angle bent to the arc of a circle and located on the frame with the center of the arc at the pintle center. It is riveted to the side braces by the rail brackets and to the center angle plate by a suitable clip.

The top carriage is a steel casting. Its rear end fits in the bearing of the frame and is bored to receive the steel pintle, a heavy pin with a long head of elliptical section, keyed in with the major axis of the ellipse on the center line of the top carriage. The pintle bolt in the center of the pintle has an elliptical head to match the pintle and at its lower end a lever with chain-and-snap fastening. When a carriage is to be limbered, the bolt is turned until its elliptical head coincides with the pintle so that both may enter the elliptical lunette transom bushing of the carriage trail; once so entered, the pintle bolt is turned 90° in the pintle and secured by its chain in that

position, the head thus preventing the disengagement of pintle and lunette.

The front end of the top carriage is provided with three bronze conical rollers which rest and run on the top-carriage rail; and with clips which embrace the edge of the rail to prevent accidental dismounting. There is also a spur located on the top of the top carriage which enters the trail-end reinforce plate of the carriage and holds the trail and top carriage in line.

The wheels are 50 inches in diameter, with tires 5 inches wide. The hubs are exactly similar and interchangeable with those in the wheels of the carriage. The axle is hollow and is made from a single piece of forged steel.

The pole is of steel and is prevented from turning in its socket by the pole pin. A pole plug is riveted in the front end of the pole, and a neck-yoke stop near the end. Just forward of the neck-yoke stop is the neck-yoke counterstop, which, with its spring, is hinged inside of the pole and works through a slot cut in the underside of the pole. A neck-yoke chafing plate is riveted to the top of the pole above the neck-yoke stop.

The doubletree and singletrees are made of flange steel formed to a U shape. The hole in the former for the doubletree pivot is bushed with a bronze nipple, held in place by a steel nut, and may be replaced when worn. Two doubletree chains reach from the ends of the doubletree to the rail brackets on the frame, to which they are bolted. The neck yoke is of steel tubing with steel sleeves and rings. The spare connecting pole is carried in brackets under the frame. A pole prop is carried on the left side brace. A bucket holder with straps is located on each side brace for carrying the four canvas watering buckets. A name plate is riveted to the left side of the pole housing, giving number, name of limber, model, name of manufacturer, year of completion, and initials of inspector. *In all reports and correspondence, the limber should be designated by the number, name, model, etc., as given on the name plate.* As repairs to the limber may from time to time be required, the parts needed should be referred to by the names given in the nomenclature of parts, and the symbols should be copied exactly as stamped upon the unserviceable pieces.

THE 6-INCH HOWITZER LIMBER AND CAISSON, MODEL OF 1909.

WEIGHTS, DIMENSIONS, ETC.

Weight of limber, empty, without implements or ammunition....	pounds..	1,866
Weight of tools and equipments carried on limber.....	do....	84
Weight of limber completely equipped and loaded.....	do....	3,948
Weight of caisson, empty, without implements or ammunition.....	do....	2,120

Weight of tools and implements on caisson, including spare connecting pole,	pounds	171
Weight of ammunition carried in caisson or limber	do	1,849
Weight of caisson completely equipped and loaded	do	4,289
Rounds of ammunition carried in limber	number	14
Rounds of ammunition carried in caisson	do	14
Diameter of wheels	inches	60
Width of track	do	60
Free height under caisson	do	19.75
Turning angle	degrees	67

Nomenclature of parts.

Number on lim- ber.	Num- ber on cais- son.	Name of part.	Location, etc.	Property classification.	
				Class.	Sec- tion.
	1	Apron	Hinged to bottom of chest front		
	3	Apron hinges, male	Riveted to top of apron		
	3	Apron hinges, female	Riveted to bottom of chest		
	3	Apron-hinge pins			
	2	Apron latches, complete, consisting of—			
	2	Latch bodies			
	2	Latch handles			
	2	Latch springs			
	2	Plungers			
	2	Handle pins			
	2	Apron-latch staples			
1	1	Ax-handle bracket	Riveted into apron		
1	1	Ax-handle bracket plate	Attached to chest sides		
1	1	Ax pocket			
1	1	Ax strap			
1	1	Ax-strap fastener, style No. 1			
1	1	Axle			
1	1	Axle bearing (2 parts) right	Riveted on outside of side plate of chest		
1	1	Axle bearing (2 parts) left	do		
1	1	Axle bearing (2 parts) right	do		
4	4	Axle-bearing bolts, and four crown nuts	do		
12	12	Axle-bearing reinforce plates	Inside of chest body under axle bearings		
1	1	Bolt snap with 3 inches of 0.125 twist coil chain	At lock bar handle catches		
	2	Brake beams, complete, consisting of—			
	2	Brake-beam bodies	Hinged to brake-beam brackets		
	2	Brake-beam stiffeners	do		
	2	Brake-rod brackets	do		
	2	Brake-shoe bearings	do		
	4	Hinges			
	1	Brake-beam bracket, right	Riveted to chest front		
	1	Brake-beam bracket, left	do		
	2	Brake-beam pins	Secure brake beams in brackets		
	2	Brake-bracket reinforce plates	Under rivets of brake shaft bearing		
	4	do			
	1	Brake crank	On left end of brake shaft		
	1	Brake guard	Riveted to right side of chest		
	1	Brake rack	do		
	1	Brake separator	do		
	1	Brake lever	do		
	1	Brake-lever catch			
	2	Brake rods, consisting of—			
	2	Brake-rod bushings	In spring cover ends		
	2	Brake-rod ends	Beam end of brake rods		
	2	Brake-rod springs	Crank end of brake rods		
	2	Brake-spring cover ends	Incose springs and plungers		
	2	Brake-spring covers			
	2	Brake rods			
	2	Brake-rod pins	Fasten brake beam and brake rod connection		
	1	Brake shaft			
	2	Brake-shaft bearings, with two bushings, 4 bronze pins, and 2 handy oilers	One on either side of chest		

Nomenclature of parts—Continued.

Number on lim- ber.	Num- ber on cais- son.	Name of part.	Location, etc.	Property classification.	
				Class.	Sec- tion.
	2	Brake shoes	On end of brake beams.....		
	2	Brake-shoe pins	Pin shoes to brake beams.....		
1	1	Bucket-holder body	On front of chest.....		
1	1	Bucket-holder strap	In strap fasteners.....		
2	2	Bucket-holder strap fasteners, style No. 10.	Riveted to chest and bucket-holder body.....		
1	1	Button bracket.....	Riveted to bucket holder.....		
	1	Caisson instruction plate.....	On caisson chest door (upper).....		
	1	Caisson prop, complete, consisting of—			
	2	Prop eyes	Hinged to connecting pole.....		
	1	Prop foot .....	....do.....		
	2	Prop tubes .....	....do.....		
1	1	Carrier stop	Inside of chest door (upper).....		
7	7	Carrier tubes	Connect rear and middle diaphragms.....		
7	7	Cartridge-case carriers, complete, consisting of—			
7	7	Bodies (in halves)	Carried in ammunition chest.....		
7	7	Front ends (in two parts) .....	....do.....		
7	7	Rear ends (in two parts) .....	....do.....		
7	7	Handles .....	....do.....		
14	14	Handle eyes .....	....do.....		
7	7	Hinge pins .....	....do.....		
7	7	Springs .....	....do.....		
7	7	Separators (in halves) .....	....do.....		
1	1	Cartridge-case carrier stop	Horizontally through chest in front of cartridge-case carriers.....		
1	1	Center bearing, right	Riveted to underside of upper intermediate plate.....		
1	1	Center bearing, left .....	....do.....		
	1	Chest body	In two sections, forms top, sides, and bottom of chest.....		
1	1	....do.....	....do.....		
1	1	Chest door (lower)	Flange steel.....		
	1	Chest door (upper)	Armor plate on caisson.....		
1	1	....do.....	Flange steel on limber.....		
1	1	Chest frame	Steel angle around chest front.....		
	1	Chest front	Armor plate on caisson.....		
1	1	....do.....	Flange steel on limber.....		
	1	Connecting pole, complete, consisting of—			
1	1	Body	Of steel tubing.....		
1	1	Caisson-prop connection	Bracket for caisson prop.....		
1	1	Key bearing	Riveted in rear end of body.....		
1	1	Lunette	In lunette bearing.....		
1	1	Lunette bearing	Riveted in front end of body.....		
2	2	Lunette pins			
	1	Wheel guard	Riveted to body.....		
1	1	Connecting-pole key	Keys connecting pole in socket.....		
	1	Diaphragm brace, with three crown nuts	Separates upper middle diaphragm and upper diaphragm, front.....		
2	2	Door angles	Stiffen edges of doors.....		
2	2	Door handle (lower) without stop	One on right side of chest door, lower, on the caisson and on limber.....		
	1	Door handle (lower) with stop	Left side of chest door, lower, on the caisson.....		
2	2	Door handles (upper)	On chest door, upper.....		
7	7	Door hinges, female			
7	7	Door hinges, male			
7	7	Door hinge pins			
2	2	Door props	Attached to door-prop stud.....		
2	2	Door-prop rivets	Slide in door-prop guides.....		
1	1	Door-prop guide, right	On side of chest		
1	1	Door-prop guide, left .....	....do.....		
2	2	Door-prop studs, with 2 crown nuts	Riveted to chest door, upper.....		
1	1	Door stiffeners, right	Inside of chest door, upper.....		
1	1	Door stiffeners, left .....	....do.....		
1	1	Doubletree, complete	See nomenclature of parts on 4.7-inch gun and 6-inch howitzer limber, model of 1905.....		
2	2	Doubletree chains	In doubletree-chain eyes.....		
2	2	Doubletree-chain clevises	Connect doubletree chains and chain eyes.....		
1	1	Doubletree-chain eye, right	Riveted to side of chest		
1	1	Doubletree-chain eye, left .....	....do.....		
2	2	Doubletree-chain pins	Fasten chain to chest		

IV 3

Nomenclature of parts—Continued.

Number on lim- ber.	Num- ber on cais- son.	Name of part.	Location, etc.	Property classification.	
				Class.	Sec- tion.
1		Doubletree-pin and crown nut.....	Attaches doubletree to pole socket on limber.		
1		Doubletree strap.....	Braces doubletree pin.....		
1	1	Filler plate.....	In pintle support, under pintle spring.		
	1	Foot rest.....	On foot-rest supports.		
	1	Foot-rest support, right.....	Riveted to chest front.		
	1	Foot-rest support, left.....	do.....		
	1	Grip strap.....	In fasteners.		
3	3	Grip-strap fasteners, style No. 7.....	Riveted to chest front.		
2	2	Handbarrow brackets.....	Riveted to upper diaphragm.		
2	2	Handles (for lock bars), right, left.....	On outer end of each lock bar.		
2	2	Handle catches.....	On handle catch bearings.		
1	1	Handle-catch bearing, right.....	Riveted on side of chest.		
1	1	Handle-catch bearing, left.....	do.....		
2	2	Handle-catch rivets.....			
	2	Handrails.....	Steel tubing.....		
	4	Handrail shanks.....	Riveted to sides of chest.		
1	1	Hatchet-blade bracket.....	On right side of chest.		
1	1	Hatchet-handle bracket.....	do.....		
1	1	Hatchet strap.....	In hatchet-blade bracket.		
8	8	Hinge pins with 8 steel pins.....	Through locking levers and bearings.		
1	1	Intermediate angle (lower).....	Riveted to intermediate plate and chest front.		
1	1	Intermediate angle (upper).....	do.....		
1	1	Intermediate plate (lower).....	Forms top of lower compartment of chest.		
1	1	Intermediate plate (upper).....	Forms bottom of upper compartment of chest.		
	1	Key.....	Secures connecting pole in pole socket.		
	1	Key bracket.....	On right side of chest.		
1	1	Lantern-bracket body.....	Riveted to chest front.		
1	1	Lantern-bracket bottom.....	Riveted in lantern-bracket body.		
1	1	Lantern strap.....	In lantern-strap fasteners.		
2	2	Lantern-strap fasteners.....	Riveted to lantern-bracket body.		
	1	Latch base, right, with washer.....	Riveted to side of chest.		
	1	Latch base, left, with washer.....	do.....		
4	4	Limber blanket straps (front).....			
4	4	Limber blanket straps (rear).....			
8	8	Limber blanket strap fasteners, style No. 5.....	On top of chest.		
1		Limber instruction plate.....	On limber chest, door, upper.		
1		Limber prop, complete, consisting of—			
1		Prop eye.....	Hinged to pole socket.		
1		Prop foot.....	do.....		
1		Prop tube.....	do.....		
2	2	Lock bars with—	Operate the locking levers.		
4	4	Pins.....	do.....		
8	8	Washers.....	On side of chest.		
1	1	Lock-bar bracket, right.....	do.....		
1	1	Lock-bar bracket, left.....	Inside of chest.		
2	2	Lock-bar bracket reinforce plates.....	Secure upper and lower doors.		
8	8	Locking levers.....	Riveted to upper and lower intermediate plates.		
6	6	Locking-lever bearings.....			
		Lower diaphragm:			
1	1	Front.....			
1	1	Middle.....			
1	1	Rear.....			
1	1	Lower stiffener:	Brace for lower intermediate plate and chest front.		
		Right.....	do.....		
1	1	Left.....	Holds lunette of spare connecting pole.		
	1	Lunette bracket.....	On left side of chest.		
	1	Lunette strap.....	On limber chest front.		
	1	Lunette-strap fastener, style No. 1.....	See nomenclature of parts of 4.7-inch gun and 6-inch howitzer limber, model of 1905.		
1	1	Name plate.....	On upper side of lower intermediate plate of caisson.		
	1	do.....	do.....		
1		Neck yoke, complete.....	Upper side of upper intermediate plate of limber.		
	1	Oil-can guide, right.....			
	1	Oil-can guide, left.....			
	1	Oil-can packing block.....			
		With—			
	2	Oval head machine screws, washers and nuts.	Fasten oil-can packing block.		

Nomenclature of parts—Continued.

Number on limber.	Number on caisson.	Name of part.	Location, etc.	Property classification.	
				Class.	Section.
2	1	Oil-can stop.....	Riveted to intermediate plate (upper).		
	2	Padlock-chain rivets.....	Riveted in sides of chest.....		
1	1	2-inch Yale lock No. 850, with bolt snap clevis, and 3 inches of 0.125 twist-cord chain.	For left lock bar handle.....		
3	3	Paulin straps.....	On top of chest.....		
3	3	Paulin-strap fasteners, style No. 3.....	On chest front.....		
3	3	Paulin-strap fasteners, style No. 10.....	On top of chest.....		
2	3	Picket-rope straps.....	On chest front.....		
	3	Picket-rope straps (upper).....	On top of chest.....		
	3	Picket-rope straps (lower).....	do.....		
4	3	Picket-rope strap fasteners, style No. 5.....	On chest front.....		
	6	do.....	On top of chest.....		
1	1	Pick-head strap.....	On pick rest.....		
	1	Pick-mattock strap.....	do.....		
1	1	Pick-head strap fastener, style No. 2.....	On left side of chest.....		
1	1	Pick-head strap fastener, style No. 1.....	do.....		
	1	Pick-mattock strap fastener, style No. 1.....	On pick rest.....		
	1	Pick-mattock strap fastener, style No. 2.....	On top of chest.....		
1	1	Pick rest.....	do.....		
1	1	Pick staple.....	do.....		
1	1	Pintle, complete, consisting of—	In pintle bearings.....		
1	1	Pintle.....	do.....		
1	1	Pintle latch.....	do.....		
1	1	Pintle-latch spring.....	do.....		
1	1	Pintle-latch pin.....	do.....		
2	2	Pintle bearings.....	Between pintle-bearing supports.....		
4	4	Pintle-bearing bolts and 4 crown nuts.....	Clamp pintle-bearing supports.....		
1	1	Pintle-bearing support (upper).....	Riveted to upper intermediate plate.....		
1	1	Pintle-bearing support (lower).....	Riveted to lower intermediate plate.....		
1	1	Pintle spring, with 2 washers, 1 bolt, and 1 crown nut.....	Bears against flat on pintle.....		
1	1	Pintle-spring guide.....	On pintle spring.....		
2	2	Plates.....	Bases for lock-bar staples.....		
1	1	Pole, complete.....	See nomenclature of parts on 4.7-inch gun and 6 inch howitzer limber, model of 1905.		
	1	Pole bracket (right).....	Supports right end of square connecting pole.....		
	1	Pole bracket (upper left).....	At left end of spare connecting pole.....		
	1	Pole bracket (lower left).....	At left end of connecting pole.....		
1	1	Pole-bracket pin.....	Through pole and pole socket.....		
1	1	Pole pin.....	On chest front.....		
1	1	Pole-prop bracket.....	On chest front under bracket.....		
1	1	Pole-prop bracket plate.....	On chest front.....		
1	1	Pole-prop pocket.....	On chest front under pocket.....		
1	1	Pole-prop pocket plate.....	On chest front.....		
2	2	Pole-prop strap.....	On pole prop bracket and bracket plate.....		
1	1	Pole-prop strap fasteners, style No. 1.....	Screwed into pole socket base.....		
	1	Pole socket with bolt and 1 crown nut.....	do.....		
	1	Pole socket (without lugs).....	Bolted to chest front.....		
1	1	Pole-socket base.....	Through chest front and pole socket base.....		
18	18	Pole-socket bolts and nuts.....	Inside of chest, between intermediate plates.....		
2	2	Pole-socket bolt filler plates.....	Connect rear and middle diaphragms.....		
14	14	Projectile tubes.....	Bolted to pole socket.....		
2	—	Prop bracket halves.....	Secures limber prop in folded position.....		
1	—	Prop chain, complete, consisting of—	do.....		
1	1	Prop chain.....	do.....		
1	1	Prop-chain fastening.....	do.....		
1	1	Prop-chain handle.....	do.....		
1	1	Prop-chain button.....	Riveted to button bracket.....		
1	1	Prop-chain eye.....	In right doubletree chain clevis.....		
	1	Prop chain, complete, consisting of—	On connecting pole.....		
	1	Prop chain.....	do.....		
	1	Prop eye.....	do.....		
	1	Prop hook.....	do.....		
1	1	Prop-eye bolt.....	do.....		
1	1	Prop-hook bolt.....	do.....		
1	1	Reinforce plate (upper).....	Above pintle bearing support, upper.....		

IV 3

Nomenclature of parts—Continued.

Number on lim- ber.	Number on cais- son.	Name of part.	Location, etc.	Property classification.	
				Class.	Sec- tion.
1	1	Reinforce plate (lower).....	Below pintle bearing support, lower.		
1	1	Shot-tongs leg pocket.....	On top of lower intermediate plate.....		
1	1	Shot-tongs pocket.....	Riveted to lower intermediate plate and chest on right.		
1	1	Shot-tongs stop.....	In fastener.....		
1	1	Shot-tongs strap.....	On top of lower intermediate plate.....		
1	1	Shot-tongs strap fastener style No. 3.....	On left side of chest.....		
1	1	Shovel-handle rest.....	do.....		
1	1	Shovel-handle strap.....	do.....		
1	1	Shovel-handle strap fastener, style No. 1.....	do.....		
1	1	Shovel support.....	do.....		
2	.....	Singletrees.....	See nomenclature of parts on 4.7-inch gun and 6-inch howitzer limber, model of 1905.		
1	.....	Spanner bracket (front).....	On right side of limber chest.....		
1	.....	Spanner bracket (rear).....	do.....		
1	.....	Spanner-bracket plate.....	do.....		
1	.....	Spanner strap.....	do.....		
1	.....	Spanner-strap fastener, style No. 1.....	On spanner-bracket plate.....		
1	.....	Spanner-strap fastener, style No. 2.....	do.....		
2	2	Tie-rods.....	Brace pole socket.....		
1	1	Tie-rod bracket (right).....	On front corners of chest.....		
1	1	Tie-rod bracket (left).....	do.....		
4	4	Tie-rod pins.....			
1	1	Upper diaphragm, (front).....			
1	1	Upper diaphragm, (rear).....			
1	1	Upper middle diaphragm.....			
1	1	Upper stiffener (right).....	Brace for upper intermediate plate and chest front.....		
1	1	Upper stiffener (left).....	do.....		
2	2	Washers.....	On brake crank and brake lever.....		
2	2	Wheels, 60-inch diameter.....	See nomenclature of parts of wheel on carriage.....		
2	2	Wheel fastenings.....	do.....		
1	.....	Wrench holder (right).....	Upper side of lower intermediate plate.....		
1	.....	Wrench holder (left).....	do.....		
1	.....	Wrench strap.....	do.....		
1	.....	Wrench-strap fastener, style No. 1.....	do.....		

DESCRIPTION OF THE 6-INCH HOWITZER LIMBER, MODEL OF 1909.

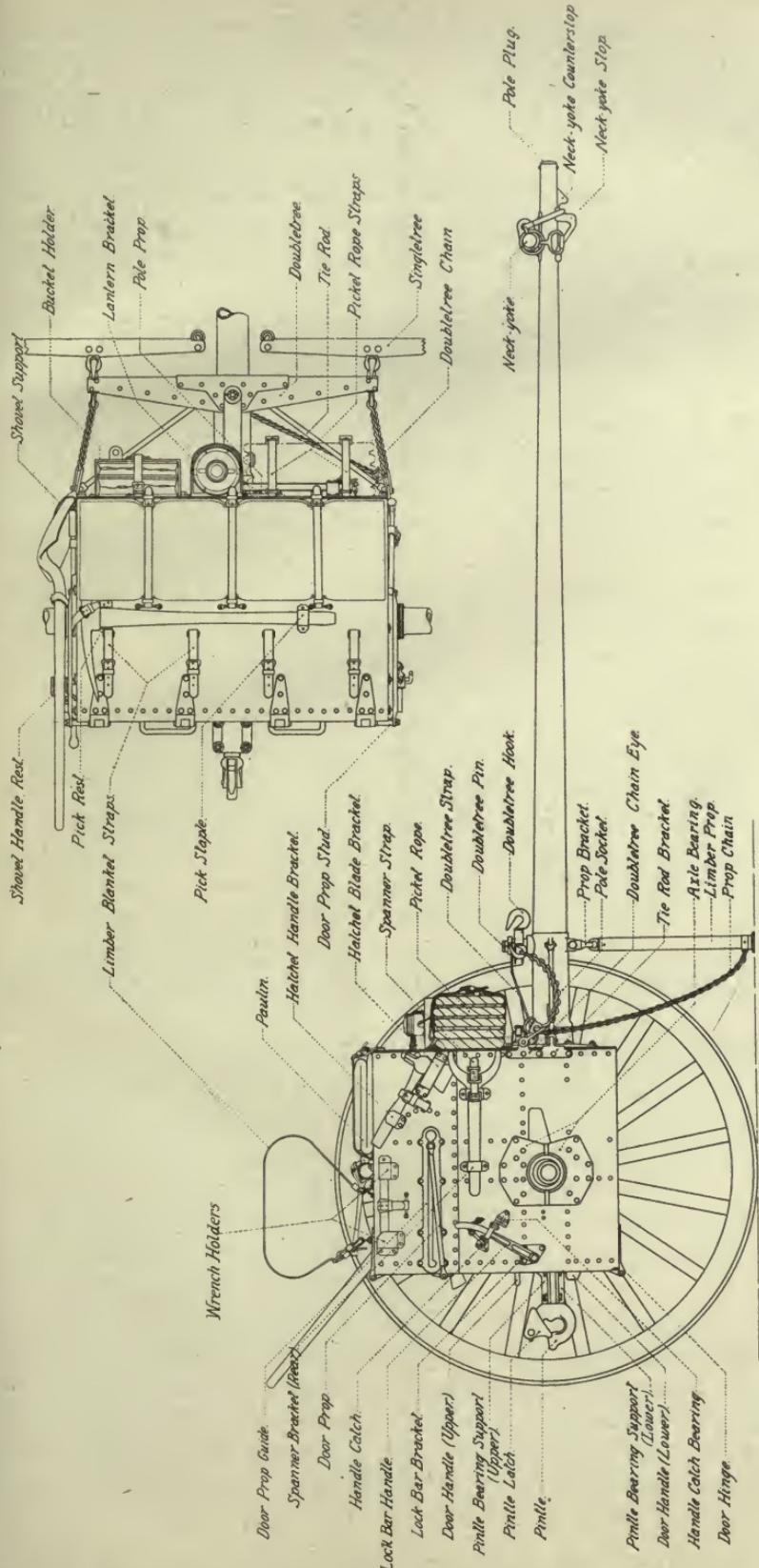
(Plate XIII.)

The limber is a two-wheeled vehicle provided with an ammunition chest for the transportation of ammunition for the 6-inch howitzer.

The principal parts are the wheels, axle, ammunition chest, pintle, pole socket, pole, limber prop, doubletree, singletree, and neck yoke.

The wheels and the wheel fastenings are the same as and interchangeable with those on the carriage. The axle is hollow, and is made from a single piece of forged steel.

The ammunition chest is built of flange steel, and is divided into an upper and lower compartment by means of the flange steel intermediate plates, upper and lower, between which passes the axle. The axle is secured to the chest by the right and left bearings riveted to the sides of the chest and to the intermediate plates. The two sections of each axle bearing are clamped together by bolts passing through lugs on the axle, thus preventing any longitudinal movement of the axle. The chest front is a flange steel plate riveted to



6-Inch Howitzer Limber, Model of 1909

Scale 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 30 40 41 42 43 44 45 46 47 48 49 40 50 51 52 53 54 55 56 57 58 59 50 60 61 62 63 64 65 66 67 68 69 60 70 71 72 73 74 75 76 77 78 79 70 80 81 82 83 84 85 86 87 88 89 80 90 91 92 93 94 95 96 97 98 99 90 100 inches.



flanges on the intermediate plates and to the vertical flanges of the chest frame, a steel angle formed into a rectangle and riveted through its horizontal flanges to the body of the chest. Four flange steel stiffeners and two steel angles brace the intermediate plates to the chest front.

Inside the chest, in the upper compartment, are located three vertical diaphragms flanged all around and riveted to the chest body and intermediate plate (upper). The front and rear diaphragms are perforated with 15 holes each, 7 designed for cartridge-case carriers and 8 for projectiles. The middle diaphragm is of smaller size, and perforated with 8 holes, to match those of the front and rear diaphragms designed for projectiles. The front and rear diaphragms are braced at their middle by a short round bolt. In the lower compartment are located three vertical diaphragms of the same size, flanged all around, and riveted to the chest body and intermediate plate (lower). The lower diaphragms have 6 perforations each for projectiles.

Corresponding holes for cartridge-case carriers in the front and rear diaphragm are connected by brass tubes called carrier tubes, which are rolled in in assembling, and serve to guide the cartridge-case carriers and stiffen the diaphragms. Similar brass tubes, called projectile tubes, extend between corresponding holes for the projectiles in the middle and rear diaphragms to guide the projectiles and stiffen those diaphragms. The perforations for projectiles in the rear diaphragms are made conical, and, after the brass trays are seated, these cones fit the taper of the rotating bands of the projectiles, forming stops for the same. The chest doors close against the rear of the projectiles, holding them firmly in position. A pressed steel beam placed transversely in the upper chest, forward of the front diaphragm, serves as a stop, determining the position of the cartridge-case carriers.

The chest door (upper) consists of a flange steel plate strengthened by a steel angle riveted to its lower edge and by two steel stiffeners of T section riveted on its inner surface. Its top edge is secured to the chest by four hinges, allowing the door to swing to the rear and upward. In its uppermost position it is held by door props attached to each end of the door and to the sides of the chest, as shown in the plate. The door bears on its outer surface an instruction plate as follows: "This chest for shell only."

The chest door (lower) is of flange steel strengthened by an angle along its upper edge, and is secured to the chest body by three hinges, which allow the door to open to the rear and downward. Two door handles are located on each door to assist in opening and closing the door. When closed, the lower edge of the upper door and the upper edge of the lower door are securely fastened by locking levers hinged

to the intermediate plates and operated by lock bars having handles on the chest sides. These lock-bar handles are held in a closed position by suitable catches, the left handle having a padlock.

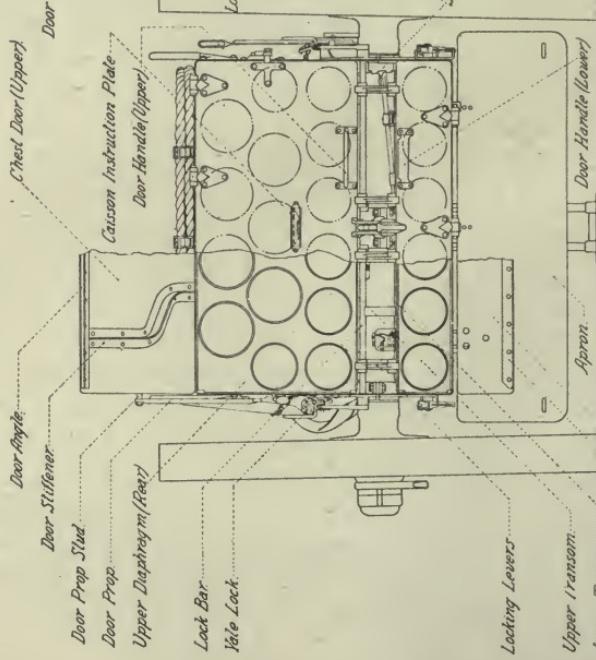
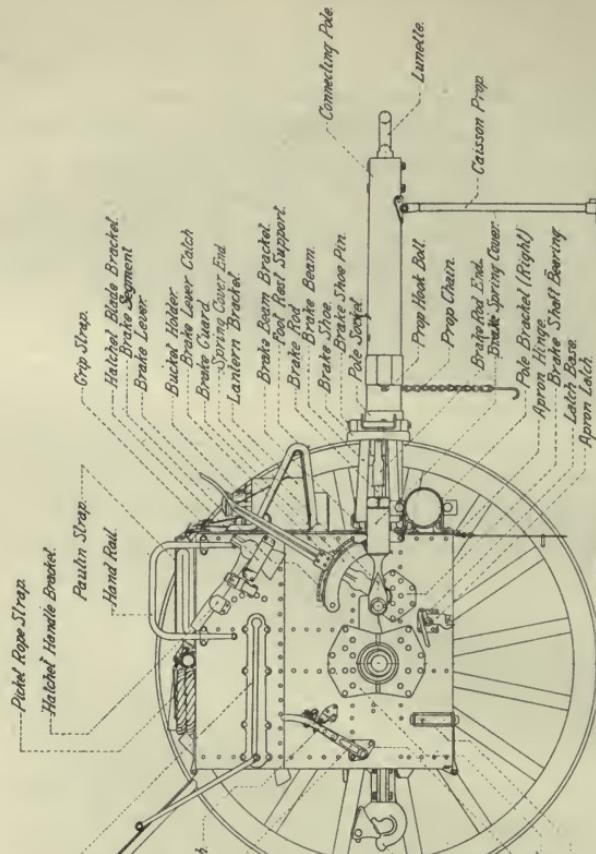
Through the chest front, intermediate angles, and intermediate plate flanges are 18 bolts, securing the pole-socket base. The cylindrical cast-steel pole socket is threaded into the pole-socket base and riveted, its interior being finished as a conical seat for the pole. The doubletree is mounted upon the doubletree pin projecting up through a boss on the forward end of the pole socket. The upper end of this pin is threaded for a nut, and is braced back to the pole socket by the doubletree strap. Tie rods attached to lugs on either side of the socket brace it to brackets riveted at the forward corners of the chest. The pole socket is split at its forward end, and is provided with a clamping bolt for drawing the socket firmly about the pole. The pole is prevented from turning by the pole pin inserted at an angle through the socket and the pole.

The clamping bolt for the socket also secures the prop bracket in place, to which the limber prop is hinged. When traveling the prop is folded back and held by the prop chain, which passes through the chain eye in the doubletree chain clevis, and secured by placing the prop-chain handle over the button on the bucket holder.

Pintle-bearing supports are riveted to the upper and lower intermediate plates at the rear of the chest, and form brackets for clamping the pintle bearing. This bearing is in two parts, secured together by bolts, and may be renewed when worn. The pintle may swivel 360° in the bearing, but is normally held in a vertical position by a spring bolted to the pintle-bearing support (lower) which bears upon a flat at the front end of the pintle shank. The lunette ring of the caisson is retained upon the pintle hook by the pintle latch. The latter is pivoted by the latch pin upon the end of the pintle horn, and is arranged to be held in either the open or closed position by the pintle-latch spring. The latch is opened by the lunette in entering it upon the pintle hook, but must be closed by hand. The spring is peened in its seat, but if required may readily be driven out and a new one inserted.

The cartridge-case carriers are half cylinders hinged together at one end and are designed to hold two cartridge cases each. The bodies and front ends are of flange steel and the rear ends are steel forgings. A folding handle on the exposed end is held in folded position by a spring, and serves as a latch to hold together the free ends of the carrier halves. The equipment of each limber includes seven cartridge case carriers.

The opening at the rear between the upper and lower intermediate plates is utilized to receive the shot tongs for removing projectiles. The shot tongs are carried in fastenings in the right side of the opening.



6-inch Howitzer Caisson Model of 1909

Scale 0 4 8 12 16 20 24 28 32 36 40 44 48 52 56 60 inches

Upon the left side of the chest front is riveted a box for carrying two canvas buckets, and in the center is a lantern bracket. A name plate above the lantern gives the name, number, and model of the vehicle, name of manufacturer, year of completion, and initials of the inspector. In all reports and correspondence the vehicle is to be designated by the number and model given on the name plate.

The fixtures for holding the pick on top of the chest will accommodate either a pickax or a pick mattock; those upon the left side for the shovel will take either a long or short handled implement. A pickax and a long-handled shovel are issued with each limber; a pick mattock and short-handled shovel with each caisson.

Other fastenings and straps are provided on top of the chest for a paulin and for kits; on the front for a pole prop and picket rope; on the left side of the chest for an ax, and on the right side for a hatchet, wrench, and a spanner for tightening the hub bands of the wheels.

The pole, doubletree, singletrees, and neck yoke are standard and interchangeable with those on any limber of the battery.

Doubletree chains attached to the chest body prevent excessive swinging of the doubletree.

DESCRIPTION OF THE 6-INCH HOWITZER CAISSON, MODEL OF 1909.

(Plate XIV.)

The 6-inch howitzer caisson is built upon the same general plan as the 6-inch howitzer limber, model of 1909, and many parts of the two vehicles, the wheels, axles, pintles and pintle bearings, lock bars, diaphragms, and most of the chest parts and implement fastenings are identical and interchangeable.

The principal parts are the wheels, axle, ammunition chest, pintle, pole socket, connecting pole, caisson prop, foot rest, apron, and brake.

The chest front and chest door (upper) are hardened armor plates 0.15 inch thick, needed for the protection of the ammunition servers in the rear from small-arms and shrapnel fire. The door bears on its outer surface an instruction plate as follows: "This chest for 5 shell and 9 shrapnel." An apron of armor plate of the same thickness is hinged to the lower edge of the chest front and extends to within a short distance of the ground, for the same purpose. To clear obstructions in traveling, the apron is made to swing to the rear up against the bottom of the chest, in which position it is held by apron latches attached to the sides of the chest.

The apron latch bases riveted to the sides of the chest are similar to those on the carriage. All other parts, with the exception of the latch handle, are the same as and interchangeable with those on the carriage.

The connecting pole, a heavy steel tube, has riveted in the rear end a forged steel key bearing which is used as a seat for the rectangular key which secures the pole to the pole socket. In the front end of the connecting pole is located the bronze lunette bearing, in which the lunette is secured by two pins.

A wheel guard to protect the connecting pole from injury from the limber wheels in making short turns is riveted to the body near its middle. As the pole seats in the sockets are the same for limber and caisson, the connecting pole may be used in place of the steel pole in the limber whenever it is desirable to connect a number of these vehicles entrain. For this purpose the body of a spare connecting pole is carried on each caisson in brackets on the chest front, the lunette is placed in a bracket on the left side of the chest, and a fixture for a spare key is provided on the right side. A caisson prop of steel tubing with a bronze foot is attached to the connecting pole for a support when the caisson is unlimbered. When not in use the prop is swung up under the connecting pole and held by a chain leading from a button on the right side of the wheel guard, under the prop to a button on the left.

The beams of the road brake are hinged in brackets riveted to the chest front. They are built up of flange and forged steel parts, and carry cast-iron shoes to bear against the wheel tires. A brake shaft passes through the chest forward of the axle and is mounted at either end in bearings riveted to the chest sides. This shaft is operated by a spring steel brake lever on the right end having a renewable brake lever catch, which engages a toothed rack riveted to the chest, to hold the brake when applied. A brake crank is assembled on the left end of the shaft in line with a similar crank arm forged integral with the hub of the brake lever. These cranks are connected to the brake rod brackets on the brake beams by elastic brake rods. The construction of the brake rod is as follows: The brake rod passes through a stiff helical spring and the end of a bronze brake spring cover, and is screwed into the brake rod end, which is joined to the brake beam by the brake rod pin. The brake spring cover end or crank end of the rod is screwed into the other end of the brake spring cover and has a guiding bushing to receive the rear end of the brake rod. The spring is compressed between the forward end of the brake spring cover and a collar on the brake rod, which is thus arranged to have a small longitudinal movement against the pressure of the spring. The tension on the spring may be regulated by screwing the brake spring cover end into or out of the brake spring cover. Adjustment to compensate for wear of brake shoes is secured by varying the distance the brake rod is screwed into the brake rod end.

Brackets supporting a short perforated sheet steel foot rest are mounted on the right side of the chest front; a handrail projects above the top of the chest on either side and with the grip strap provides handhold for a cannoneer. The picket rope for the caisson is carried in fastenings on top of the chest. The paulin strapped to the top of the chest serves as a seat cushion.

The shovel, ax, pick, hatchet, lantern, shot tongs, and bucket fastenings are similar to those of the limber.

The opening at the rear between the upper and lower intermediate plates on the left side is utilized to carry an oil can. The oil can with a capacity of 2.25 gallons, is held between two steel angles riveted to the intermediate plate (lower), and oil can packing block and stop bolted to the intermediate plate (upper), and a stop on the door handle (lower). In each four caissons, three oil cans carry lubricating oil, and the fourth hydroline oil, the contents of each being indicated by a name plate.

A name plate is attached to each caisson chest front above the lantern. *In all reports and correspondence the caisson is to be designated by the name, model, and number given on this plate.* In request for spare parts for repairs, etc., the parts are to be asked for by the names given in the table giving the nomenclature of parts, and the symbol or piece mark of the unserviceable piece copied exactly as stamped thereon.

THE 6-INCH HOWITZER LIMBER AND CAISSON, MODEL OF 1916.

WEIGHTS, DIMENSIONS, ETC.

Weight of limber, empty, without implements or ammunition....	pounds..	1,905
Weight of tools and implements carried on limber, including spare connecting pole.....	pounds..	185
Weight of limber completely equipped and loaded.....	do....	4,088
Weight of caisson, empty, without implements or ammunition.....	do....	2,065
Weight of tools and implements carried on caisson.....	do....	100
Weight of caisson completely equipped and loaded.....	do....	4,163
Weight of ammunition carried in limber or caisson.....	do....	2,000
Rounds of ammunition carried in limber.....	number..	14
Rounds of ammunition carried in caisson.....	do....	14
Diameter of wheels.....	inches..	60
Width of track.....	do....	60
Free height under caisson.....	do....	19.75
Turning angle.....	degrees..	71

Nomenclature of parts.

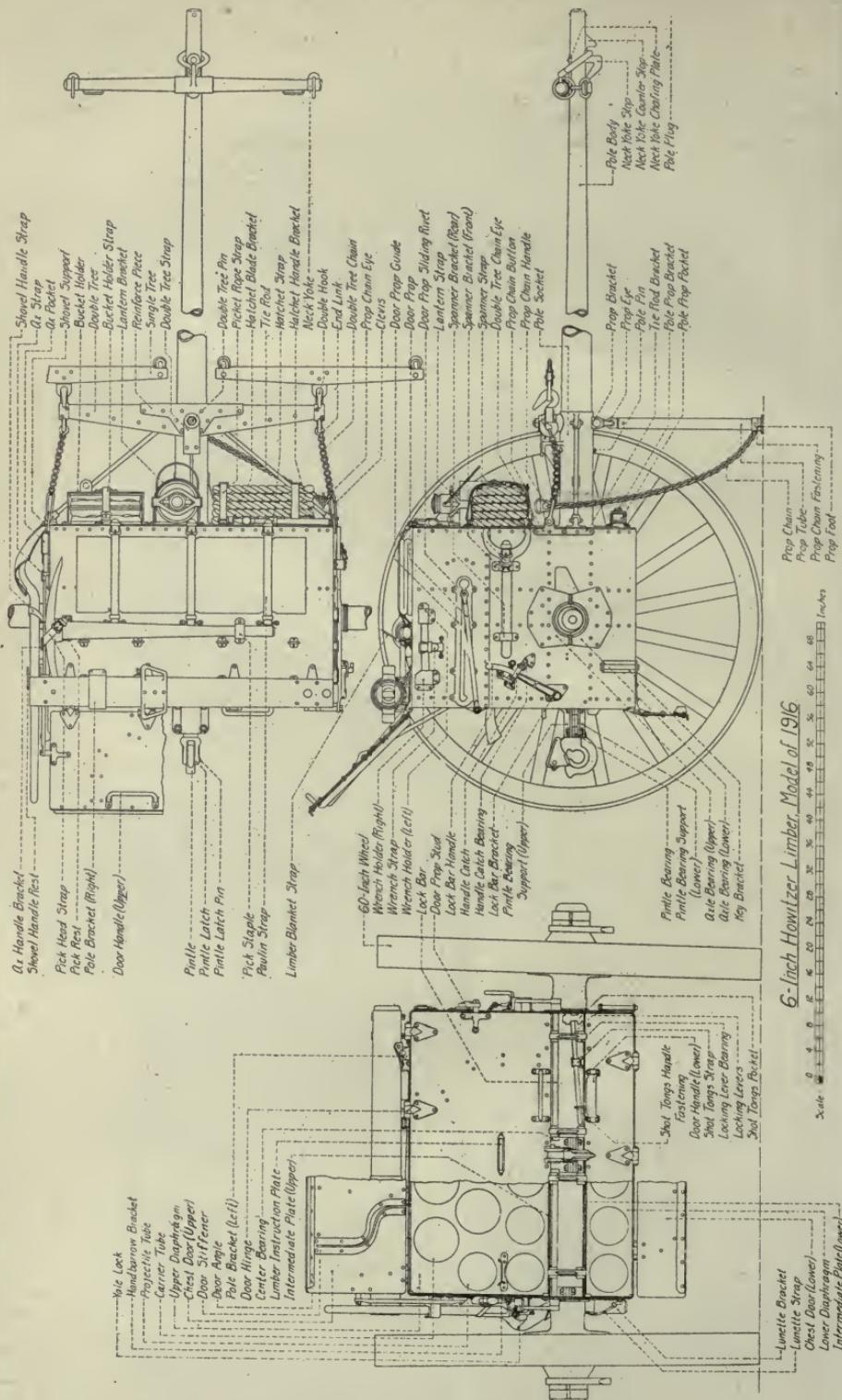
Number on lim- ber.	Num- ber on cais- son.	Name of part.	Location, etc.	Property classification.	
				Class.	Sec- tion.
	1	Apron	Hinged to bottom of chest.....		
	3	Apron hinges, male.....	Riveted to top of apron.....		
	3	Apron hinges, female.....	Riveted to bottom of chest.....		
	2	Apron latches, complete, consisting of—			
	2	Apron-latch bases, right and left.....	Riveted to chest sides.....		
	2	Apron-latch washers.....	On latch base pins.....		
	2	Handle pins.....	Pin latch handles to latch bodies.....		
	2	Latch-base pins.....	Pin latch bodies to apron latch bases.....		
	2	Latch bodies.....			
	2	Latch springs.....	Around plungers.....		
	2	Latch handles.....	Pinned to latch bodies.....		
	2	Plungers.....	In latch bodies.....		
	2	Apron-latch staples.....	Riveted into apron.....		
1	1	Ax-handle bracket.....	Riveted to ax handle bracket plate.....		
1	1	Ax-handle bracket plate.....	On right side of chest.....		
	1	do.....	On left side of chest.....		
	1	Ax pocket.....	On right side of chest.....		
	1	do.....	On left side of chest.....		
	1	Ax strap.....	In strap fastener.....		
	1	do.....	On left side of chest.....		
1	1	Axle.....	On right side of chest.....		
1	1	Axle bearing, lower left.....	Riveted outside of side plate of chest.....		
	1	do.....	do.....		
	1	Axle bearing, lower right.....	do.....		
	1	do.....	do.....		
	1	do.....	do.....		
	1	do.....	do.....		
	1	do.....	do.....		
	2	Brake beams, complete	See nomenclature of parts of 6-inch howitzer limber and caisson, model of 1909.....		
	1	Brake-beam bracket, left	Riveted to rear of chest		
	1	Brake-beam bracket, right	do.....		
	2	Brake beam pins	Secure brake beams in brackets.....		
	1	Brake crank	On right end of brake shaft.....		
	1	Brake guard	Bolted to brake segment rack.....		
	1	Brake-guard separator	Between brake guard and segment rack.....		
	1	Brake lever	On left end of brake shaft.....		
	1	Brake-lever catch	Riveted to brake lever.....		
	2	Brake rods, complete	See nomenclature of parts of 6-inch howitzer limber and caisson, model of 1909.....		
	2	Brake-rod pins	Pin brake rod ends to brake beam brackets.....		
	1	Brake segments rack	Riveted to left side of chest.....		
	1	Brake shaft	In brake-shaft bushings.....		
	2	Brake-shaft bushings	In axle bearings, lower.....		
	2	Brake shoes	On end of brake beams.....		
	2	Brake-shoe pins	Pin shoes to brake beams.....		
1	1	Bucket-holder body	On front of chest.....		
	1	do.....	On rear of chest.....		
1	1	Bucket-holder strap	In strap fasteners.....		
2	2	Bucket-holder strap fasteners, style No. 10	Riveted to chest and bucket holder body.....		
1	1	Button bracket	Riveted to bottom of bucket holder		
1	1	Button bracket reinforce	do.....		
	1	Caisson instruction plate	On chest door, upper.....		
	1	Caisson prop, complete	See nomenclature of parts of 6-inch howitzer limber and caisson, model of 1909.....		
1	1	Carrier stop	Inside of chest door, upper.....		
7	7	Carrier tubes	Connect diaphragms.....		
7	7	Cartridge-case carriers	See nomenclature of parts of 6-inch howitzer limber and caisson, model of 1909.....		
1	1	Cartridge-case carrier stop	Horizontally through chest in front of cartridge-case carriers.....		
1	1	Center bearing, left	Riveted to underside of intermediate plate, upper.....		
1	1	Center bearing, right	do.....		
1	1	Chain, complete with bolt snap, chain ring, and chain rivet	At lock bar handle catch.....		

Nomenclature of parts—Continued.

Number on lim- ber.	Num- ber on cais- son.	Name of part.	Location, etc.	Property classification.	
				Class.	Sec- tion.
1	1	Chest angle.	Riveted to chest body and front plate.		
	1	do.	Riveted to chest body and rear plate.		
1	1	Chest body.	In two sections, forms top, sides, and bottom of chest.		
1	1	Chest door, lower.	Flange steel.		
1	1	Chest door, upper.	do.		
1	1	do.	Armor plate.		
1	1	Chest front plate.	Flange steel.		
	1	Chest rear plate.	Armor plate.		
	1	Connecting pole, complete.	See nomenclature of parts of 6-inch howitzer limber and caisson, model of 1909.		
1	1	Diaphragm brace, with three crown nuts.	Separates upper middle diaphragm and upper diaphragm.		
2	2	Door angles.	Stiffen edges of doors.		
2	2	Door handles, lower, without stop.	On chest door, lower.		
	1	do.	On left side of chest door, lower.		
	1	Door handle, lower, with stop.	On right side of chest door, lower.		
2	2	Door handles, upper.	On chest door, upper.		
7	7	Door hinges, female.	Riveted to chest.		
7	7	Door hinges, male.	Riveted to chest doors.		
2	2	Door props.	Attached to door-prop stud.		
1	1	Door-prop guide, left.	On side of chest.		
1	1	Door-prop guide, right.	do.		
2	2	Door-prop sliding rivets.	Slide in door-prop guides.		
2	2	Door-prop studs.	Riveted to chest door, upper.		
1	1	Door stiffener, left.	Inside chest door, upper.		
1	1	Door stiffener, right.	do.		
1	1	Doubletree, complete.	See nomenclature of parts on 4.7-inch gun and 6-inch howitzer limber, model of 1905.		
2	1	Doubletree chains, complete.	do.		
1	1	Doubletree-chain eye, left.	Riveted to side of chest.		
1	1	Doubletree-chain eye, right.	do.		
1	1	Doubletree pin.	Attaches doubletree to pole socket.		
1	1	Doubletree strap.	Braces doubletree pin.		
1	1	Filler plate.	In pintle support, under spring.		
	1	Foot rest.	On foot-rest supports.		
	1	Foot-rest support, left.	Riveted to rear of chest.		
	1	Foot-rest support, right.	do.		
	1	Grip strap.	In left paulin-strap fastener.		
2	2	Hand-barrow brackets.	On upper diaphragms.		
1	1	Handle, left (for lock bar).	On outer end of lock bar.		
1	1	Handle, right (for lock bar).	do.		
2	2	Handle catches.	On handle-catch bearings.		
1	1	Handle-catch bearing, left.	Riveted on side of chest.		
1	1	Handle-catch bearing, right.	do.		
2	2	Handle-catch rivets.	Pin handle catches to handle-catch bearings.		
2	2	Handle-catch staples.	In handle-catch staple plates.		
1	1	Handle-catch staple plate, left.	Riveted to side of chest.		
1	1	Handle-catch staple plate, right.	do.		
	4	Handrail shanks.	Riveted to sides of chest.		
	2	Handrail tubes.	In handrail shanks.		
1	1	Hatchet, blade bracket.	Riveted on chest front plate.		
	1	do.	Riveted on chest rear plate.		
1	1	Hatchet-handle bracket.	Riveted on chest front plate.		
	1	do.	Riveted on chest rear plate.		
1	1	Hatchet strap.	In strap fastener.		
1	1	Hatchet-strap fastener, Style No. 1.	Riveted to chest front plate.		
	1	do.	Riveted to chest rear plate.		
1	1	Intermediate angle, lower.	Brace for chest front and intermediate plate, lower.		
1	1	Intermediate angle, upper.	Brace for chest front and intermediate plate, upper.		
1	1	Intermediate plate, lower.	Forms top of lower compartment of chest.		
	1	do.	do.		
1	1	Intermediate plate, upper.	Forms bottom of upper compartment of chest.		
	1	do.	do.		
1	1	Key.	Secures connecting pole in pole socket.		
1	1	Key bracket.	On right side of chest.		
1	1	Lantern-bracket body.	Riveted to chest front plate.		
	1	do.	Riveted to chest rear plate.		
1	1	Lantern-bracket bottom.	Riveted in lantern bracket body.		
1	1	Lantern strap.	In strap fastener.		

Nomenclature of parts—Continued.

Number on lim- ber.	Number on cais- son.	Name of part.	Location, etc.	Property classification.	
				Class.	Sec- tion.
2	2	Lantern-strap fasteners.....	Riveted to lantern bracket.....		
4		Limber-blanket straps, front.....	In strap fasteners.....		
4		Limber-blanket straps, rear.....	.....do.....		
8		Limber-blanket strap fasteners, style No. 5.....	Riveted to top of chest.....		
1		Limber instruction plate.....	On chest door, upper.....		
1		Limber prop, complete.....	See nomenclature of parts of 6-inch howitzer limber and caisson, model of 1909.....		
2	2	Lock bars.....	Operate locking levers.....		
1	1	Lock-bar bracket, left.....	On side of chest.....		
1	1	Lock-bar bracket, right.....	.....do.....		
4	4	Lock-bar pins.....	Through lock bar and locking levers.....		
8	8	Lock-bar washers.....	On lock-bar pins.....		
8	8	Locking levers.....	Secure upper and lower doors.....		
6	4	Locking-lever bearings.....	Riveted to upper and lower inter- mediate plates.....		
		Lower diaphragms:			
1	1	Front.....	In lower compartment of chest.....		
1	1	Middle.....	.....do.....		
1	1	Rear.....	.....do.....		
1		Lunette bracket.....	On left side of chest.....		
1		Lunette strap.....	In strap fastener.....		
1		Lunette-strap fastener, style No. 1.....	Riveted to left side of chest.....		
1		Name plate.....	On chest front plate.....		
	1	.....do.....	On chest rear plate.....		
	1	Neck yoke, complete.....	See nomenclature of parts of 4.7-inch gun and 6-inch howitzer limber, model of 1905.....		
	2	Oil-can guides.....	On upper side of intermediate plate, lower.....		
	1	Oil-can packing block.....	On underside of intermediate plate, lower.....		
	1	Oil-can stop.....	On underside of intermediate plate, upper.....		
1	1	2-inch Yale padlock, with bolt snap, clevis, chain, and rings.....	At lock-bar handle catch.....		
3	3	Paulin straps.....	In strap fasteners.....		
3		Paulin-strap fasteners, style No. 3.....	On chest front plate.....		
3		Paulin-strap fasteners, style No. 7.....	On chest rear plate.....		
3	3	Paulin-strap fasteners, style No. 10.....	On top of chest.....		
2		Picket-rope straps.....	In strap fasteners.....		
	3	Picket-rope straps, lower.....	.....do.....		
	3	Picket-rope straps, upper.....	.....do.....		
4		Picket-rope strap fasteners, style No. 5.....	Riveted to chest front plate.....		
	6	.....do.....	Riveted to top of chest.....		
1		Pick-head strap.....	In strap fasteners.....		
1		Pick-head strap fastener, style No. 1.....	On left side of chest.....		
1		Pick-head strap fastener, style No. 2.....	On pick rest.....		
	1	Pick-mattock strap.....	In strap fasteners.....		
	1	Pick-mattock strap fastener, style No. 1.....	On right side of chest.....		
	1	Pick-mattock strap fastener, style No. 2.....	On pick rest.....		
1	1	Pick rest.....	Riveted on top of chest.....		
1	1	Pick staple.....	.....do.....		
1	1	Pintle, complete.....	See nomenclature of parts of 6-inch Howitzer limber and caisson, model of 1909.....		
2	2	Pintle bearings.....	Between pintle bearing supports.....		
1	1	Pintle-bearing support, lower.....	Riveted to intermediate plate, lower.....		
1	1	Pintle-bearing support, upper.....	Riveted to intermediate plate, upper.....		
2	2	Pintle-bearing washers.....	On pintle-spring bolt.....		
1	1	Pintle spring.....	Bears against flat on pintle.....		
1	1	Pintle-spring guide.....	On pintle spring.....		
1		Pole, complete.....	See nomenclature of parts of 4.7-inch gun and 6-inch howitzer limber, model 1905.....		
1		Pole bracket, left.....	Riveted to top of chest.....		
1		Pole bracket, right.....	.....do.....		
1		Pole pin.....	Through pole and pole socket.....		
1		Pole-prop bracket.....	On chest-front plate.....		
1		Pole-prop bracket plate.....	Under pole-prop bracket.....		
1		Pole-prop pocket.....	On chest-front plate.....		
1		Pole-prop pocket plate.....	Under pole-prop pocket.....		
1		Pole-prop strap.....	In strap fasteners.....		
2		Pole-prop strap fasteners, style No. 1.....	On pole-prop bracket and bracket plate.....		



Nomenclature of parts—Continued.

Number on lim- ber.	Num- ber on cais- son.	Name of part.	Location, etc.	Property classification.	
				Class.	Sec- tion.
1	1	Pole socket.....	Bolted to chest-front plate.....		
		Do.....	Between intermediate plates, upper and lower.		
2		Pole-socket bolt-filler plates.....	Inside of chest between intermediate plates.		
14	14	Projectile tubes.....	Connect rear and middle diaphragms.		
1		Prop bracket.....	Riveted to prop eye.		
1		Prop chain, complete.....	See nomenclature of parts of 6-inch howitzer limber and caisson, model of 1909.		
	1	do.....	do.....		
1		Prop-chain button.....	On bucket holder.		
1		Prop-chain eye.....	In doubletree chain clevis.		
	1	Prop-eye bolt.....	On connecting pole.		
	1	Prop-hook bolt.....	do.....		
12	12	Reinforce plates.....	For axle bearing.		
2	2	do.....	For lock-bar bracket.		
1	1	Reinforce plate, lower.....	Above pintle-bearing support, lower.		
1	1	Reinforce plate, upper.....	Above pintle-bearing support, upper.		
2		Singletrees.....	See nomenclature of parts of 4.7-inch gun and 6-inch howitzer limber, model of 1905.		
1	1	Shot-tongs handle fastening.....	Riveted to intermediate plate, lower.		
1	1	Shot-tongs pocket.....	Riveted to inside of chest and interme- diate plate, lower.		
1	1	Shot-tongs stop.....	Riveted to inside of chest.		
1		Shot-tongs strap.....	In strap fastener.		
1	1	Shot-tongs strap fastener, style No. 3	Riveted to intermediate plate, lower.		
1		Shovel-handle rest.....	On left side of chest.		
	1	do.....	On right side of chest.		
1	1	Shovel-handle strap.....	In strap fastener.		
1		Shovel-handle strap fastener, style No. 1.....	On left side of chest.		
	1	do.....	On right side of chest.		
1		Shovel support.....	On left side of chest.		
	1	do.....	On right side of chest.		
1		Spanner bracket, front.....	do.....		
1		Spanner-bracket plate.....	Under spanner bracket, front.		
1		Spanner bracket, rear.....	On right side of chest.		
1		Spanner strap.....	In strap fasteners.		
1		Spanner strap fastener, style No. 1.....	On spanner-bracket plate.		
1		Spanner-strap fastener, style No. 2.....	On spanner bracket, front.		
2		Stiffeners, right.....	Braces for chest front and interme- diate plate, upper.		
2		Stiffeners, left.....	do.....		
2		Tie-rods.....	Brace pole socket.		
1		Tie-rod bracket, left.....	On front corner of chest.		
1		Tie-rod bracket, right.....	do.....		
1	1	Upper diaphragm.....	In upper compartment of chest.		
1	1	do.....	do.....		
1	1	Upper middle diaphragm.....	do.....		
2	2	Wheels, 60-inch diameter.....	See nomenclature of parts of 6-inch howitzer carriage, model of 1908.		
2	2	Wheel fastenings.....	do.....		
1		Wrench holder, left.....	On right side of chest.		
1		Wrench holder, right.....	do.....		
1		Wrench strap.....	In strap fastener.		
1		Wrench-strap fastener, style No. 10.....	On right side of chest.		

DESCRIPTION OF THE 6-INCH HOWITZER LIMBER, MODEL OF 1916.

(Plate XV.)

The 6-inch howitzer limber, model of 1916, is similar in design to the 6-inch howitzer limber, model of 1909, and most of the parts of the two vehicles are identical and interchangeable with the exception of the ammunition chest body, intermediate plates, front plate, axle bearings, pole socket, pole bracket, double tree strap, and some of the implement fastenings.

The seats in the pole sockets are the same for limber and caisson and a connecting pole identical with that used on the caisson may be used in place of the regular limber pole whenever it is desired to connect a number of these vehicles entrain. The body of a spare connecting pole is carried on the top of the chest, the lunette is carried in a bracket on the left side of the chest, and the spare key is carried on the right side.

The hatchet is carried on the front of the chest instead of on the side. The name plate is riveted on the front of the chest above the lantern.

DESCRIPTION OF THE 6-INCH HOWITZER CAISSON, MODEL OF 1916.

(Plate XVI.)

The 6-inch howitzer caisson, model of 1916, differs principally from the 6-inch howitzer caisson, model of 1909, in that the ammunition chest is reversed in position, the chest doors opening toward the front. Most of the parts of the two vehicles are identical and interchangeable with the exception of the ammunition chest body, intermediate plates, rear plate, axle bearings, pole socket, pole bracket, brake details, and some of the implement fastenings. A number of the parts of this caisson are also identical and interchangeable with parts of the 6-inch howitzer limber, model of 1916, and the 6-inch howitzer limber, model of 1909.

The rear plate of the chest and chest door (upper) are hardened armor plates 0.15 inch thick, needed for the protection of the ammunition servers, in front of the caisson and in the rear of the limber, from small-arms and shrapnel fire. An apron of armor plate of the same thickness and for the same purpose is hinged near the middle of the chest bottom and extends to within a short distance of the ground. To clear obstructions in traveling, the apron is made to swing to the rear up against the bottom of the chest, in which position it is held by apron latches attached to the sides of the chest.

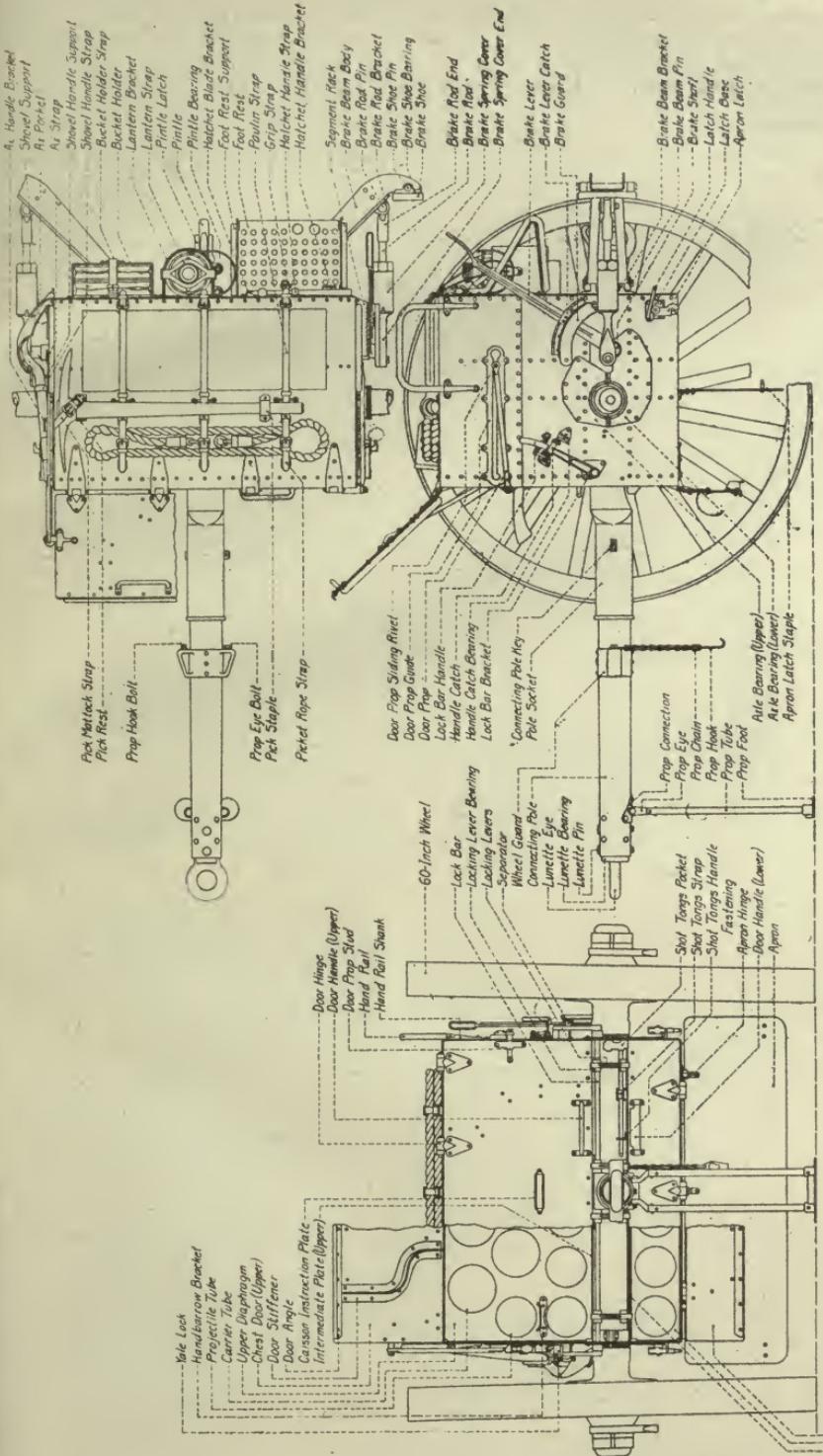
The spare connecting pole parts are carried on the limber instead of the caisson, and the hatchet is carried at the rear of the chest instead of on the side. The name plate is riveted on the rear of the chest above the lantern.

THE 4.7-INCH GUN AND 6-INCH HOWITZER FORGE LIMBER, MODEL OF 1908, AND THE 4.7-INCH GUN AND 6-INCH HOWITZER STORE LIMBER, MODEL OF 1908.

(These limbers are common to the 4.7-inch gun and 6-inch howitzer batteries.)

WEIGHTS, PRINCIPAL DIMENSIONS, ETC.

Weight of forge limber, empty, without implements, etc.....	pounds..	1,654
Weight of forge limber, fully equipped.....	do....	2,499
Weight of forge limber and battery wagon, model of 1908, combined, fully equipped.....	pounds..	7,568



5-Inch Howitzer Caisson, Model of 1916.

Weight of store limber, empty, without implements, etc.....	pounds..	1,629
Weight of store limber, fully equipped.....	do....	2,184
Weight of store limber and store wagon, model of 1908, combined, fully equipped.....	pounds..	7,711
Weight upon pintles of either forge or store limbers, from battery wagon or store wagon.....	pounds..	100
Diameter of wheels.....	inches..	60
Width of track.....	do....	60
Free height above track under wagon for either combination.....	do....	17
Turning angle.....	degrees..	65

Nomenclature of parts.

Number on forge lim- ber.	Num- ber on store lim- ber.	Name of part.	Location, etc.	Property classification.	
				Class.	Sec- tion.
2		Arbor clips.....	Part of grindstone packing.....		
1	1	Axle.....	Riveted to sides of chest.....		
2	2	Axle bearings, right and left.....	Clamp axle bearings.....		
2	2	Axle bearing bolts, with nuts.....	Under axle bearings rivets.....		
4	4	Axle-bearing reinforces.....	On left side of chest.....		
1	1	Ax blade bracket.....	do.....		
1	1	Ax-handle support.....	do.....		
1	1	Ax strap.....	do.....		
1	1	Ax-strap fastener, style No. 2.....	Temporary locks for doors.....		
4	6	Bolt snaps with 4-inch chains.....			
2	1	Chain staples.....			
1	1	Chest body, right side.....			
1	1	Chest body, left side.....			
1	1	Chest bottom.....			
2	2	Chest braces, right and left.....	Frames of upper front door openings.....		
1	2	Chest floor, upper, with— Floor braces, right and left.....			
1	1	Chest-floor reinforce.....	Middle rail, upper, to chest floor.....		
2	2	Chest frames, front and rear.....	Reinforce lower edge of chest.....		
2	2	Chest front doors, upper.....	Swing up under foot rest.....		
2	2	Chest front doors, lower.....			
2	2	Chest rear doors, upper, right and left.....	Swing down.....		
2	2	Chest rear doors, lower.....	do.....		
2	2	Chest reinforces.....	At foot rest bracket rivets.....		
1	1	Chest top angle.....	Around top of chest.....		
	1	Cushion, for battery commander's telescope, consisting of— Block.....	In compartment No. 5.....	IV	9
	1	Cleats.....	do.....		
	1	Cover.....	do.....		
	1	Filling.....	do.....		
	3	Cushions, for buzzers, consisting of— Blocks.....	In compartments Nos. 1, 2, and 3.....		
	3	Covers.....	do.....		
	3	Fillings.....	do.....		
	3	Grips.....	do.....		
2	2	Die-box holders, right and left.....	Riveted to inside of lid.....		
1	1	Die-box holder spring, with hinge and hinge pin.....			
1	1	Die-box pocket.....	Riveted to inside of lid.....		
4	4	Door hinges.....	On rear doors.....		
12	8	Door hinges, lower.....	On front and rear doors.....		
16	8	Door hinges, upper.....			
16	8	Door-hinge pins.....			
8	4	Door-hinge filler pieces, lower.....			
2	2	Door-hinge filler pieces, upper.....			
1	1	Doubletree.....	Same as on carriage limber.....		
2	2	Doubletree chains.....	From doubletree to foot rest.....		
2	2	Doubletree chain bolts.....			
1	1	Doubletree pin with nut.....			
1	1	Doubletree strap.....			
	1	End cleat, front, left.....	In pole clamp.....		
	1	End cleat, front, right.....	On doubletree pin.....		
	1	End cleat, rear, left.....	In corners of upper chest.....		
	1	End cleat, rear, right.....	do.....		
2	2	End fillers.....	do.....		
	1	End lining, left.....	Back of hammer packing.....		
	1	End lining, right.....	In ends of chest.....		
			do.....		

Nomenclature of parts—Continued.

Number on forge limber.	Number on store limber.	Name of part.	Location, etc.	Property classification.	Class.	Section.
3	3	False bottoms, consisting of— Bodies.....	For compartments Nos. 1, 2, and 3.....			
3	3	Braces.....	do.....			
6	6	Ends.....	do.....			
1	1	False bottom, consisting of— Body.....	For compartment No. 4.....			
1	1	Brace.....	do.....			
2	2	Ends.....	do.....			
1	1	False bottom, consisting of— Body.....	For compartment No. 5.....			
1	1	Brace.....	do.....			
2	2	Ends.....	do.....			
2	2	False bottoms, consisting of— Bodies.....	For compartments Nos. 6 and 7.....			
2	2	Braces.....	do.....			
4	4	Ends.....	do.....			
1	1	False bottom, consisting of— Body.....	For compartment No. 10.....			
1	1	Brace.....	do.....			
2	2	Ends.....	do.....			
1	1	Fastener clip stud.....	On grindstone upper packing.....			
	2	Filler strips, long.....	Riveted to underside of intermediate floors.....			
1	2	Filler strips, short.....	do.....			
1	1	Flat bastard file fastening.....	On packing block for small tools.....			
1	1	Floor lining, front piece.....	In bottom of upper chest.....			
1	1	Floor lining, rear piece.....	do.....			
1	1	Front lining.....	In front of upper chest.....			
1	1	Front lining end cleat, left.....	Screwed to front lining.....			
1	1	Front lining end cleat, right.....	do.....			
1	1	Front lining middle cleat.....	do.....			
2	2	Floor stiffeners, right and left.....	Brace rear of intermediate floors.....			
	2	Floor stiffeners.....	do.....			
1	1	Foot rest.....	Riveted to chest and middle rail.....			
1	1	Foot-rest brace.....	Riveted to foot rest.....			
2	2	Foot-rest brackets, right and left.....	At sides of foot rest.....			
2	2	Foot-rest supports, right and left.....	Suspend outer corners of foot rest.....			
2	2	Forge punch and creaser fastenings.....	Riveted to lid.....			
2	2	Forge fastenings.....	Riveted to transverse partition, right.....			
1	1	Forge-legs fastening, No. 1.....	do.....			
1	1	Forge-legs fastening, No. 2.....	On hanger.....			
1	1	Grindstone-legs fastening.....	On right upper grindstone packing.....			
1	1	Grindstone-legs-fastening clip.....	On fastener clip stud.....			
1	1	Grindstone-legs-fastening lock.....	Riveted under chest floor.....			
1	1	Grindstone-legs hanger.....	do.....			
1	1	Grindstone-legs pocket.....	Riveted to intermediate floor.....			
2	2	Grindstone-packing tracks, inner and outer.....	Bolted to chest floor.....			
1	2	Grindstone strap.....	Slides in left upper rear compartment.....			
2	2	Grindstone upper packing, right and le t.....	For upper packing.....			
1	2	Grindstone lower packing.....	On lower packing.....			
2	2	Grindstone-packing bolts and nuts.....	On front of lid.....			
1	3	Grindstone plate.....	do.....			
3	3	Grip straps.....	In upper chest, rear compartment.....			
3	3	Grip-strap fasteners, style No. 7.....	do.....			
1	1	Hammer packing, right, with cover plate.....	Riveted to side of chest.....			
1	1	Hammer packing, left, with cover plate.....	do.....			
2	2	Handrail brackets, rear.....	In handrail brackets.....			
2	2	Handrail brackets, front.....	In compartments 8 and 9.....			
2	2	Hand-rail tubes.....	On rear of lid.....			
1	1	Hand-rail seats.....	do.....			
1	1	Hasp.....	On right side of chest.....			
1	1	Hasp hinge.....	do.....			
1	1	Hasp-hinge pin.....	do.....			
1	1	Hatchet-blade bracket.....	do.....			
1	1	Hatchet-handle fastener.....	do.....			
1	1	Hatchet strap.....	do.....			

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Nomenclature of parts—Continued.

Number on forge lim- ber.	Num- ber on store lim- ber.	Name of part.	Location, etc.	Property classification.	
				Class.	Sec- tion.
1		Horseshoe packing, right, consisting of—			
1		Front	Upper chest, horseshoe compartment.		
1		Rear	do		
1		Inner	do		
1		Outer	do		
1		Bottom	do		
1		Horseshoe packing, left, consisting of—			
1		Front	do		
1		Rear	do		
1		Inner	do		
1		Outer	do		
1		Bottom	do		
2		Intermediate floors, right and left.	Between chest floor and chest bottom		
2	2	do	do		
1		Jack-lever bracket, No. 1	Bolted to bottom of chest.		
1		Jack-lever bracket, No. 2	do		
2		Jack packing strap, No. 1			
2		Jack packing strap, No. 2			
1	1	Lantern-bracket body	Riveted to front of chest		
1	1	Lantern-bracket bottom			
1	1	Lantern strap	In strap fasteners		
2	2	Lantern-strap fasteners	Riveted to lantern-bracket body		
2		Lever-jack packing, consisting of—			
2		Packing "A"	In bottom of chest		
2		Packing "B"	do		
2		Packing "C"	do		
2		Packing "D"	do		
4		Pins	do		
1	1	Lid			
1	1	Lid band	Reinforce edges of lid		
4	4	Lid hinges, lower	On chest front		
4	4	Lid hinges, upper	On lid		
4	4	Lid-hinge pins			
1	1	Lid lining, front	Inside of lid		
1	1	Lid-lining strip	do		
1	1	Lid lining, middle	do		
1	1	Lid lining, rear	do		
1	1	Lid prop, with rivet	Supports open lid		
1	1	Lid-prop bracket	On lid		
1	1	Lid-prop guide, right	On right longitudinal partition		
1	1	Lid-prop guide, left	Inside of chest ends		
1	1	Lid-prop guide, right	do		
4	4	Lid-prop-guide fillers (end)	Under lid-prop guides		
2	2	Lid-prop-guide fillers (middle)	do		
1	2	Lid-prop sliding rivets	In lid props and guides		
1		List of contents	Pasted to lid		
4		Lock-bar hinges, lower	On lower edge of chest, rear		
4		Lock-bar hinges, upper	On rear of chest		
8		Lock-bar-hinge pins			
2		Longitudinal partitions, right and left.			
1	1	Middle rail, lower	Extends through chest, front to rear		
1	1	Middle rail, upper	do		
1		Name plate	On front of chest		
1	1	do	do		
1	1	Neck yoke, complete	Same as with carriage limber		
4		Oil-can lock bars, lower	Secure lower oil cans		
4		Oil-can lock bars, upper	Secure upper oil cans		
8		Oil-can packing blocks, No. 1	In oil-can compartments		
4		Oil-can packing blocks, No. 2	do		
2		Oil-can packing blocks, No. 3, right and left.	do		
2		Oil-can packing blocks, No. 4	do		
2		Oil-can packing blocks, No. 5	do		
2		Oil-can packing blocks, No. 6, right and left.	do		
2		Oil-can packing blocks, No. 7	do		
1		Oiler fastening	On packing for anvil		
1		Packing for anvil	In center compartment of upper chest		
1		Packing for forge	do		
1		Packing for small tools	do		
124		Pads, complete, with lining	In chest compartments		
4	4	Padlock-chain rivets, long	For lock chains		
4	2	Padlock-chain rivets, short	do		

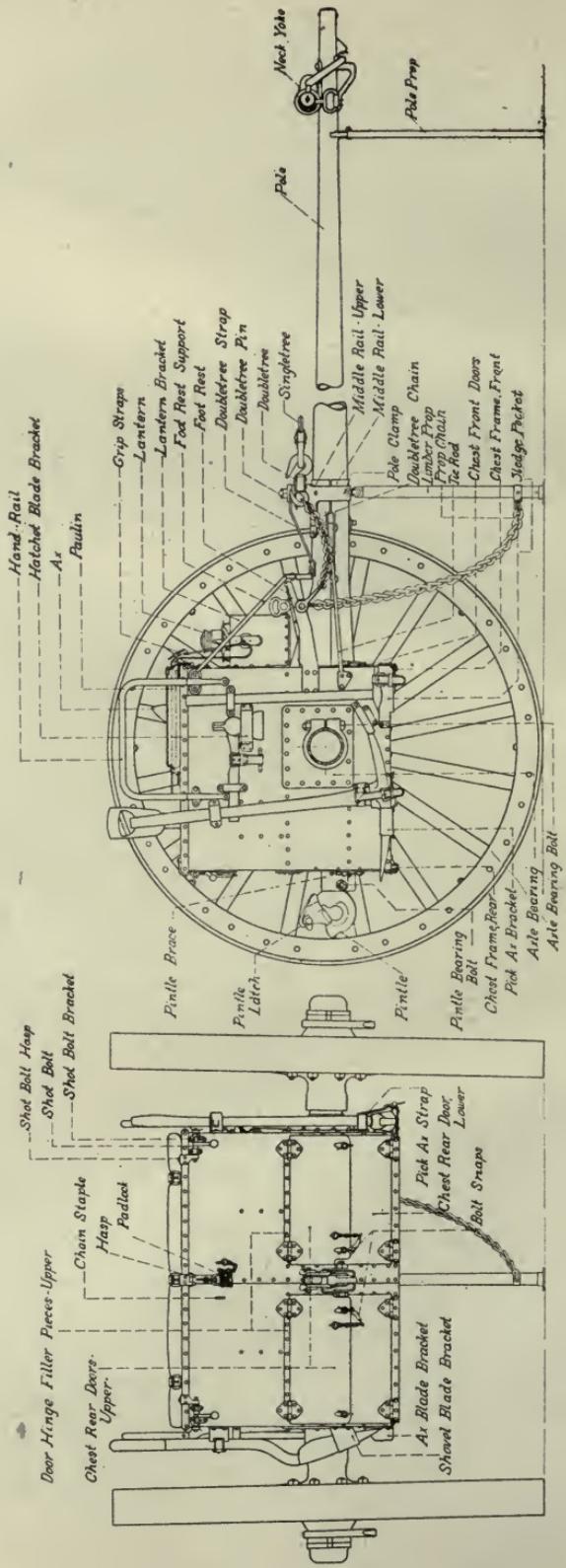
Nomenclature of parts—Continued.

Number on forge lim- ber.	Num- ber on store lim- ber.	Name of part.	Location, etc.	Property classification.
				Class. Sec- tion.
1	.....	Padlock, with 4-inch chain	Marked "4.7-inch gun and 6-inch howitzer forge limber, model 1908. No. —"	
.....	1	..... do	Marked "4.7-inch gun and 6-inch howitzer store limber, model 1908. No. —"	
.....	2	Partitions "A"	Between compartments 1, 2, and 3	
.....	1	Partition "B"	Between compartments 3 and 4	
.....	1	Partition "C"	Between compartments 4 and 5	
.....	1	Partition "D"	Between partitions "B" and "C"	
.....	1	Partition "E"	Front longitudinal partition	
.....	1	Partition "F"	Middle longitudinal partition	
.....	1	Partition "G"	Between compartments 6 and 7	
.....	1	Partition "H," body	Between compartments 7 and 8	
.....	2	Partition "H," guides (small)	Screwed to partition "H," body	
.....	1	Partition "J," body	Between compartments 8 and 9	
.....	2	Partition "J," guides (small)	Screwed to partition "J" body	
.....	2	Partition "J," guides (large)	do	
.....	1	Partition "K," body	Between compartments 9 and 10	
.....	2	Partition "K," guides (large)	Screwed to partition "K," body	
.....	1	Partition "L,"	Right side of compartment 10	
.....	1	Partition brace	Over partition "H"	
.....	2	Partition guides	For partition "E"	
.....	2	Partition guides (bottom)	Brace partition "F"	
.....	22	Partition guides (side)	For all partitions except "E"	
.....	72	Partition-guide stops	Riveted in partition guides	
3	3	Paulin straps	On top of chest	
3	3	Paulin-strap fasteners, style No. 10	do	
1	1	Pick-ax bracket	On right side of chest	
1	1	Pick-ax bracket filler	On chest bottom	
1	1	Pick-handle rest		
1	1	Pick-head strap		
1	1	Pick-head strap fastener, style No. 12		
1	1	Pick-point support		
1	1	Pintle, complete, including—		
1	1	Pintle	In pintle bearing	
1	1	Pintle latch	do	
1	1	Pintle-latch spring	do	
1	1	Pintle-latch pin	do	
1	1	Pintle bearing	In rear end of middle rail	
1	1	Pintle brace	Forms rear end of middle rail, riveted to chest floor	
1	1	Pintle spring	Riveted to middle rail, lower	
1	1	Pintle-spring pin		
.....	1	Pocket for T. I. recorders, including—		
.....	1	Box (2 side pieces, 1 bottom piece, 1 front piece)		
.....	1	Fastener	Attached to right end of partition "F"	
.....	1	Fastener chape		
.....	1	Lining		
.....	1	Flap		
1	1	Pole, complete	Same as on carriage limber	
1	1	Pole clamp	On middle rail	
1	1	Pole-clamp bolt, with nut		
1	1	Pole pin	Secures pole in pole seat	
1	1	Pole-pin reinforce	Riveted to middle rail	
1	1	Pole-prop pocket	Under left side of foot rest	
1	1	Pole-prop support		
1	1	Pole-prop strap		
1	1	Pole-prop strap fastener, style No. 1		
1	1	Pole stop		
1	1	Prop, complete, consisting of—	Riveted between middle rails	
1	1	Prop eye	Hinged to prop bracket	
1	1	Prop foot	do	
1	1	Prop tube	do	
1	1	Prop bracket	Riveted to pole clamp	
1	1	Prop chain, consisting of—		
1	1	Prop chain	Secures prop in folded position	
1	1	Prop chain fastening	do	
1	1	Prop chain handle	do	
1	1	Prop-chain button	Riveted to foot rest	
1	1	Prop-chain button rivet		
1	1	Rear lining	In rear of upper chest	
1	1	Rear-lining end cleat, left	Hinged to prop bracket	
1	1	Rear-lining end cleat, right	do	
1	1	Rear-lining middle cleat	do	

IV

9

6311-17---9



47-Inch Gun and 6-inch Howitzer Forge Limber, Model of 1908

Scale 1:100

Nomenclature of parts—Continued.

Number on forge lim- ber.	Number on store lim- ber.	Name of part.	Location, etc.	Property classification.	
				Class.	Sec- tion.
2	2	Separators.....	Riveted between middle rails.....		
1	.....	Shoeing-rasp fastening.....	On packing for small tools.....		
2	.....	Shot bolts for grindstone packing.....	On lower packing.....		
2	2	Shot bolts, right and left.....	In shot-bolt brackets.....		
2	2	Shot-bolt brackets, right and left.....	Riveted to rear of chest.....		
2	2	Shot-bolt filler pieces.....			
2	2	Shot-bolt hasps, right and left.....	Riveted to lid.....		
2	2	Shot-bolt stops.....	Riveted to shot-bolt brackets.....		
1	1	Shovel-blade bracket.....	On left side of chest.....		
1	1	Shovel-handle support.....			
1	1	Shovel-handle strap.....			
2	.....	Side fillers.....	Back of hammer packing.....		
2	2	Singletrees.....	Same as on carriage limber.....		
1	.....	Sledge-handle support.....	On right side of forge limber.....		
1	.....	Sledge pocket.....			
1	.....	Sledge strap.....			
1	.....	Sledge-strap fastener, style No. 10.....			
10	10	Springs.....	Under cushion for buzzers and battery commander's telescope.....	IV	9
1	.....	Square fastening.....	Riveted to lid.....		
6	.....	Stamped washers.....	Under rivets in packing tracks.....		
2	2	Tie-rods, right and left.....	Brace forward end of middle rail to chest.....		
2	.....	Transverse partitions, front, right, and left.....	In upper chest, extend from chest sides to longitudinal partition.....		
2	.....	Transverse partitions, rear, right and left.....	.....do.....		
6	6	Washers.....	For buzzer cushion springs.....		
4	4	.....do.....	For cushion under battery commander's telescope.....		
2	2	Wheels, 60-inch.....	Same as on carriage.....		
2	2	Wheel fastenings.....	.....do.....		
6	6	Wing nuts.....	Secure doors and lock bars.....		
4	.....	Wing-nut brackets, with washers.....	Riveted to intermediate floors.....		
1	1	Wing-nut filler piece.....	On wing nut pin.....		
2	7	Wing-nut pins, with washers.....	Riveted in chest braces.....		
16	20	0.312 (5/16) rivet reinforces.....	Under lid hinges.....		
8	8	0.375 rivet reinforces.....	Under handrail brackets.....		

DESCRIPTION OF THE 4.7-INCH GUN AND 6-INCH HOWITZER FORGE LIMBER, MODEL OF 1908.

(Plate XVII.)

The forge limber is a two-wheeled vehicle designed to accompany the battery wagon, model of 1908, and fitted to carry the tools and supplies pertaining to a farrier's shop with the addition of some machinist's tools.

The principal parts are the wheels, axle, chest, middle rail, pintle, foot rest, pole clamp, pole, limber prop, doubletree, singletrees, and neck yoke.

The wheels and wheel fastenings are the same as those upon the carriage. The axle is hollow, made of a single piece of forged steel and is made identical with the axles of the store limber, model of 1908, and battery and store wagons, model of 1908.

The axle passes through the chest between horizontal plates and is secured to the chest sides by axle bearings riveted to the chest.

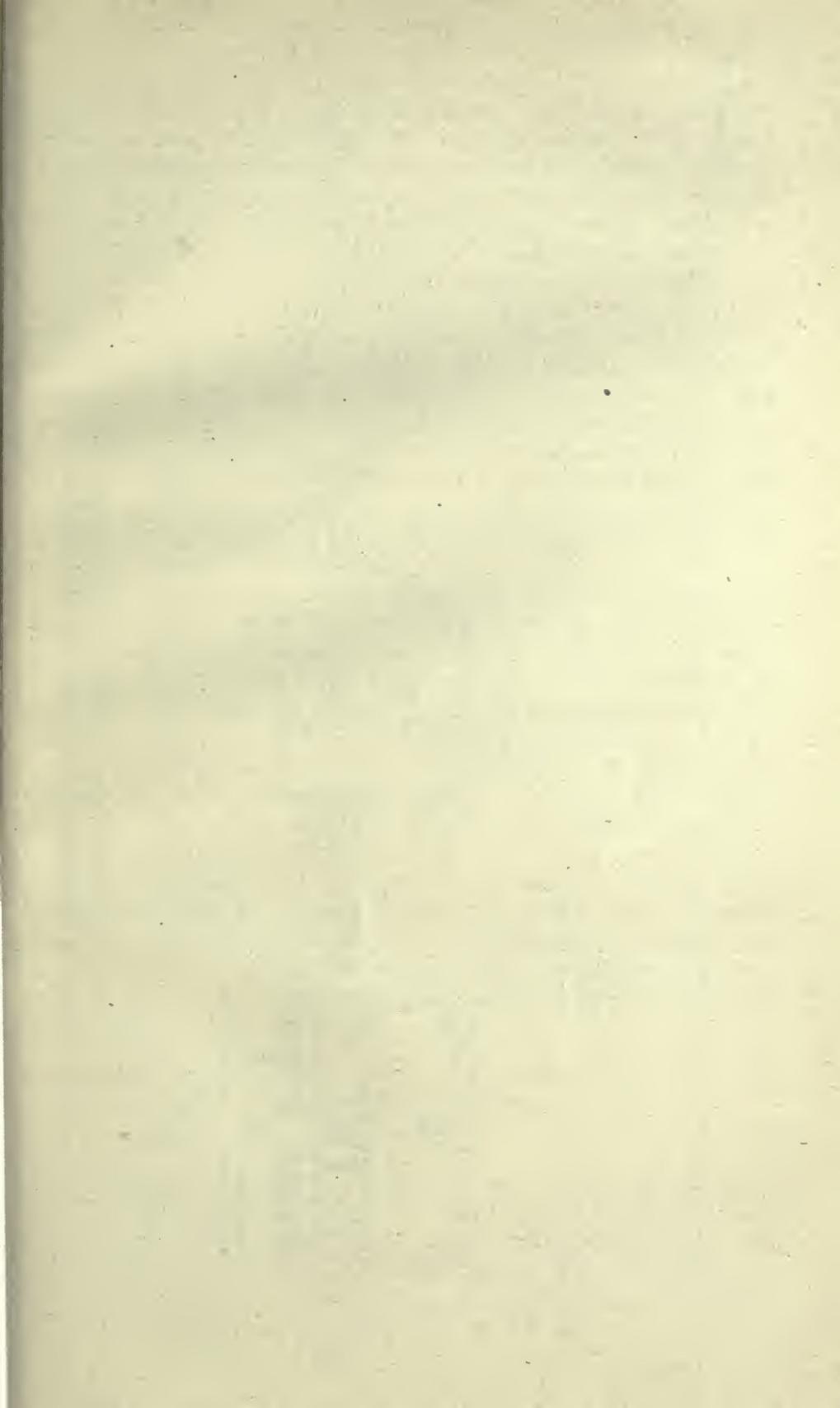
The chest is formed from flanged-steel plates and is divided by the horizontal plates above and below the axle into three sections, the upper being fitted to carry the forge, anvil, blacksmith's tools, horseshoes, and supplies, and entered from the top. The upper edges of the body plates are reinforced by a steel angle; the lid which covers this upper section is a steel plate with its edges reinforced by a steel band. The lid hinges are in front.

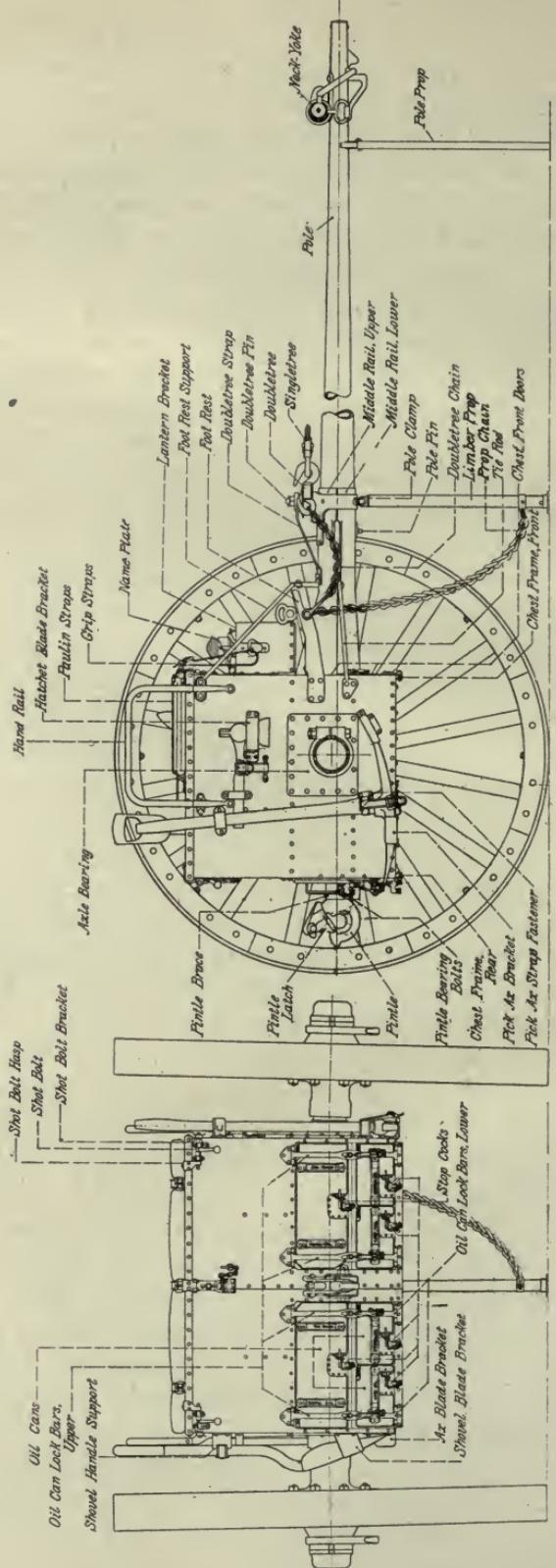
Two longitudinal partitions divide the upper chest into a middle compartment and two side compartments, and each side compartment is subdivided by two transverse partitions. The forward side compartments are wood lined and have a capacity of 350 pounds of horseshoes, to be carried loose in the box; the intermediate side compartments will take 50 pounds of horseshoe nails either loose or in the 25-pound box of nails as issued; the rear side compartments are fitted for carrying tools. The middle compartment is fitted to take the field forge in front, the anvil in the center, and several small tools in fastenings on the rear wall. The anvil and forge are bedded in wooden seats on the chest floor and are held in position by attachments on the lid. The latter is held in its open position by a lid prop which is hinged to a door prop bracket riveted to the underside of the lid and having at its other end a button running in a lid prop guide riveted to the right longitudinal partition. Other attachments on the underside of the lid form fastenings for a steel square and a box of dies and taps for cutting threads. Shot bolts at each rear corner and a hasp and turnbuckle with padlock in the middle secure the lid when closed.

The space between the intermediate plates and in front of the axle is to be used for carrying the picket rope and water buckets; doorways are cut through the front of the chest for admission thereto and closed by drop doors. The similar space to the rear of the axle is entered through doorways cut in the rear of the chest; the right side is intended for the tackle blocks, the left side being fitted with packing blocks for the grindstone and its frame. The grindstone frame legs are to be assembled in their fastenings before the block containing the stone and frame is slid into place.

The lower section of the chest is fitted to carry two lever jacks, one on either side; 150 feet of 1-inch manila rope for the tackle blocks is to be carried either in this compartment or above as proves most convenient. Openings in the front and rear of the chest for admission to the lower compartment are closed by doors which swing down to open. Corresponding doors to the compartment above swing up to open and when closed overlap the lower doors to shed rain water. These doors are secured by wing nuts with bolt snaps.

The socket for the pole, instead of being bolted to the chest front as in the limber and caisson, has for its lower member a flange steel





A 7-Inch Gun and 6-Inch Howitzer Store Limber. Model of 1908.

channel or middle rail which extends to the rear through the chest, its rear end forming a seat for the pintle. This middle rail, lower, divides the lower horizontal plate or intermediate floor and is riveted to flanges turned downward on the two sections of the plate so formed.

The upper part of the pole socket middle rail, upper, is riveted to the upper horizontal plate or chest floor, upper, and to strong reinforces in the front of the chest as well as to the lower middle rail.

The pole clamp forms a seat for the doubletree pin and has a bolt in lugs on the left side for drawing the two parts of the middle rail firmly about the pole. On the underside of the pole clamp is riveted the prop bracket, to which the limber prop is hinged. The doubletree pin is exactly similar to that on the caisson limber and is braced by a doubletree strap as on that vehicle. The pintle and pintle latch are interchangeable with those of the limber and caisson; the pintle bearing is of bronze and in two sections and is secured by two bolts passing through the middle rail and pintle brace. The latter is formed of flange steel and braces the pintle and middle rail to the chest floor above.

A foot rest is riveted to the chest front, its forward edge being shaped to fit the middle rail to which it is riveted, and its forward corners tied to the handrail brackets on the chest sides by round supports. Foot-rest brackets of flange steel reinforce the ends of the foot rest, and to these are fastened doubletree chains extending to the doubletree and preventing excessive movement thereof.

The pole, neck yoke, doubletree, and singletrees are standard with those of the other battery vehicles. The paulin on the lid is to serve as a seat cushion; attachments for carrying a sledge hammer, a hatchet, and a pickax are on the right side of the chest; a lantern bracket is riveted to the chest front and fastenings for a short-handled shovel and an ax are on the left side of the chest. A folding pole prop is carried in fastenings on the underside of the foot rest. A name plate is riveted on the front of the chest and gives the name, number, and model of the vehicle for reference in correspondence and reports.

DESCRIPTION OF THE 4.7-INCH GUN AND 6-INCH HOWITZER STORE LIMBER, MODEL OF 1908.

(Plate XVIII.)

This vehicle, designed to accompany the store wagon, model of 1908, is very similar to the 4.7-inch gun and 6-inch howitzer forge limber, model of 1908; the wheels, axle, axle bearings, middle rail, pintle brace, pintle and bearing, pole clamp, doubletree bolt, tie-rods, foot rest, etc., being identical in the two vehicles. The chests differ only in the fittings for the articles to be carried.

The upper chest of the store limber is fitted with compartments for carrying the fire-control equipment, viz:

3 buzzers, service model 1914, in cases.

3 inspector's pocket kits, each containing—

1 pocket knife.

1 pair scissors.

1 wire cutter.

1 half-round file.

1 pair tweezers.

1 screw driver.

1 2-foot rule.

1 battery commander's telescope, in case.

6 field glasses, type "E," in cases.

2 hand reels.

2 spools of single buzzer wire.

1 battery case (containing 6 dry cells).

3 plugs for buzzers, with connection lines.

3 battery commander's rulers, in cases.

2 time-interval recorders.

2 chains for time-interval recorders.

8 semaphore kits.

1 battery commander's telescope tripod, in case.

1 100-foot steel tape.

Spare parts for buzzer.

The compartments for buzzers, pocket kits, battery commander's telescope, field glasses, and battery case are padded to protect the contents from injury.

The intermediate and lower sections of the store limber are arranged to carry six oil cans for the reserve supply of oils. In the intermediate section to the rear of the axle are two rectangular cans made of heavy sheet brass, each having a capacity of 7.5 gallons of coal oil. In the lower section are four longer cans of 5 gallons' capacity each, two for lubricating oil and two for hydroline oil. Each can is provided with a filling hole on top and with a special stopcock at the rear end. The stopcock is placed so that oil may be conveniently drawn without removing the cans from the limber. Wearing strips of brass are soldered to the bottoms of the cans and contact blocks on the forward ends of each can embrace projections to hold each can in place when the others are removed. Wooden packing strips to serve as guides for the cans are bolted to the floors and walls of the compartments. Instead of doors on the rear of the chest the cans are secured by lock bars, held in closed position by wing nuts and bolt snaps.

No sledge-hammer fastenings are placed on the store limber. With this exception the implement fastenings are the same as on the forge limber. The name plate is riveted on the front of the chest.

THE BATTERY AND STORE WAGONS, MODEL OF 1908.

Nomenclature of parts.

Number in one battery wagon.	Number in one store wagon.	Name of part.	Location, etc.	Property classification.	
				Class.	Section.
1	1	Axle.....	Same as on forge and store limber		
2	2	Axle bearings.....	Riveted inside rails.....		
4	4	Axle clamping bolts and nuts.....	Assembled in axle bearings.....		
4	4	Axle clamping sleeves.....	do.....		
1	1	Brake beam, complete, including—			
2	2	Brake-beam bearing plates.....	In brake-beam guides.....		
10	10	Brake-beam end fillers.....	do.....		
2	2	Brake-beam end plugs.....	do.....		
2	2	Brake-beam guide plugs, 1 right, 1 left.	do.....		
10	10	Brake-beam middle fillers.....	do.....		
2	2	Brake-beam reinforce plates.....	do.....		
2	2	Brake-beam stops.....	do.....		
2	2	Brake-shoe bearings.....	do.....		
2	2	Brake-beam guides, 1 right, 1 left.	Riveted to side rails.....		
2	2	Brake-beam plungers.....	Assembled in guides.....		
2	2	Brake-beam springs.....	do.....		
1	1	Brake connecting rod.....	do.....		
1	1	Brake crank.....	On brake shaft.....		
1	1	Brake-crank cover.....	Riveted to brake cross brace.....		
1	1	Brake cross brace.....	Connects side rails through front of chest.....		
1	1	Brake cross brace stiffener.....	Riveted to brake cross brace.....		
1	1	Brake lever.....	On right end of brake shaft.....		
1	1	Brake-lever catch.....	Riveted to brake lever.....		
1	1	Brake-lever hook.....	do.....		
1	1	Brake nut.....	Assembled in brake beam.....		
1	1	Brake segment rack.....	Riveted to chest.....		
1	1	Brake shaft.....	In brake shaft bearing.....		
1	1	Brake-shaft bearing.....	Riveted to brake cross brace.....		
2	2	Brake shoes.....	Pinned in brake shoe bearings.....		
2	2	Brake-shoe pins.....	In brake shoes and bearings.....		
1	1	Brake stud.....	Screws into brake nut.....		
1	1	Brake-stud bearing.....	Riveted in brake beam.....		
2	2	Chest bottom plates, 1 right, 1 left.	All riveted together to form chest.....		
1	1	Chest compartment.....	do.....		
2	2	Chest floor hoods, 1 right, 1 left.....	do.....		
2	2	Chest floor stiffeners.....	do.....		
2	2	Chest intermediate floor plates, 1 right, 1 left.	do.....		
1	1	Chest lower floor plate.....	do.....		
2	2	Chest lower front ends, 1 right, 1 left.	do.....		
1	1	Chest partition.....	do.....		
1	1	Chest rear end.....	do.....		
1	1	Chest rear end reinforce.....	do.....		
2	2	Chest reinforce strips.....	do.....		
2	2	Chest sides, 1 right, 1 left.....	do.....		
1	1	Chest top.....	do.....		
2	2	Chest top reinforcements.....	do.....		
1	1	Chest upper floor plate, front.....	do.....		
2	2	Chest upper floor plates, rear.....	do.....		
1	1	Chest upper front end.....	do.....		
1	1	Chest upper front end reinforce.....	do.....		
2	2	Chest lower doors, complete, including—			
2	2	Chest lower door center hinges.....	Close lower compartments.....		
4	4	Chest lower door end hinges.....	do.....		
2	2	Chest lower door hasps.....	do.....		
2	2	Chest lower door hinge rivets.....	do.....		
2	2	Chest lower door staples.....	do.....		
8	8	Door handles.....	Riveted to large doors.....		
32	32	Door-handle reinforces.....	Under door-handle rivets.....		
8	8	Door hinges, female.....			
6	6	Door hinges, male.....			
8	8	Door hinge, female, reinforces.....			
8	8	Door-hinge pins.....			
2	2	Fastening nuts.....	On spare pole fastening bolts.....		
4	1	Fastening washers.....	do.....		
1	1	Foot rest.....	Riveted to foot-rest supports.....		
2	2	Foot-rest supports, 1 right, 1 left.	Riveted to upper front-door plate.....		

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Nomenclature of parts—Continued.

Number in one battery wagon.	Number in one store wagon.	Name of part.	Location, etc.	Property classification.	
				Class.	Section.
2	2	Lid props, including—			
2	2	Eyes.	Hold door in open position.		
2	2	Fillers.	do		
2	2	Guides	do		
2	2	Reinforces	do		
4	4	Lock bars.	Secure doors.		
4	4	Lock-bar hinges, front and rear.	Riveted to chest.		
2	2	Lock-bar hinge, front, reinforces.	Inside of chest.		
2	2	Lock-bar hinge, rear, reinforces.	do		
4	4	Lock-bar hinges, top.	Riveted to chest.		
4	4	Lock-bar hinge, top, reinforces.	Inside of chest.		
1	1	Lunette.	In lunette bearing.		
1	1	Lunette bearing.	At front end of rails.		
2	2	Lunette pins.	Secure lunette in bearing.		
1	1	Name plate.	Riveted to chest rear end.		
6	6	Padlocks, with chains.	Lock doors.		
4	4	Padlock chain rivets.	Attach chains to lock bars.		
2	2	Prop chains.	Hold prop in folded position.		
2	2	Prop-chain guides.	On wheel guard cross brace.		
1	1	Prop-chain take-up.	do		
1	1	Prop, consisting of—			
2	2	Prop-cha'n clamps.	Riveted or pinned together.		
1	1	Prop foot.	do		
1	1	Prop head.	do		
2	2	Prop legs.	do		
1	1	Prop pin.	Connects prop to lunette bearing.		
1	1	Prop hook.	Joins prop chains.		
1	1	Rear door casing.	Riveted to chest.		
1	1	Rear door frame.	Riveted to rear door plate.		
2	2	Rear door hinge, male, reinforces.	Inside of chest.		
2	2	Rear door hooks.	Pinned in supports.		
2	2	Rear door hook pins.	Pin hooks in supports.		
2	2	Rear door hook springs.	In rear door hook support.		
2	2	Rear door hook support.	Riveted to chest rear end.		
1	1	Rear door plate.	Hinged to chest rear end.		
2	2	Rear door studs.			
2	2	Side rails, 1 right, 1 left.	Form frame of wagon.		
2	2	Spare pole compartment sides, 1 right, 1 left.	Riveted to chest.		
2	—	Spare pole fastening bolts.	Support large end of poles.		
1	—	Spare pole fastening bracket.	Riveted to side rails near lunette bracket.		
1	—	Spare pole fastening bracket reinforce, lower.	Riveted to bracket.		
1	—	Spare pole fastening bracket reinforce, upper.	do		
1	—	Spare pole rest.	Riveted to spare pole compartment sides.		
1	—	Spare pole rest cover.	Sewed on spare pole rest.		
1	—	Spare pole support, inner.	Riveted together to spare pole compartment sides.		
1	—	Spare pole support, outer.	do		
1	—	Spare pole support cover, inner.	On spare pole support.		
1	—	Spare pole support cover, outer.	do		
2	2	Spare wheel casings.	Riveted to chest sides.		
4	4	Spare wheel fastenings, lower, consisting of—			
4	4	Lower wheel fastening bolts.	Pinned in hinges.		
4	4	Lower wheel fastening guards, inside.	Riveted to chest.		
4	4	Lower wheel fastening guards, outside.	do		
4	4	Lower wheel fastening hasps.	Pinned in hinges.		
4	4	Lower wheel fastening hinges.	Strap outside of wheels.		
4	4	Lower wheel fastening hooks.	Riveted to chest sides.		
4	4	Thongs.	In eye of hooks.		
4	4	Spare wheel fastenings, upper, complete, consisting of—			
4	4	Upper wheel fastening clips.	Nut levers.		
4	4	Upper wheel fastening bars, 2 right, 2 left.	Strap outside of wheel.		
4	4	Upper wheel fastening hinges.	Riveted on chest.		
4	4	Upper wheel fastening nuts.	On swing bolts.		
4	4	Upper wheel fastening pins.	In swing bolts and hinges.		
4	4	Upper wheel fastening reinforcements, 2 right, 2 left.	Riveted inside of chest.		
4	4	Upper wheel fastening rivets.	Hinge studs to bars.		

IV

9

Nomenclature of parts—Continued.

Number in one battery wagon.	Number in one store wagon.	Name of part.	Location, etc.	Property classification.
				Class. Section.
4	4	Spare wheel fastenings, upper, complete, consisting of—Contd.		
		Upper wheel fastening sockets, 2 right, 2 left.	Riveted on chest.	
4	4	Upper wheel fastening studs.	Screwed into sockets.	
4	4	Upper wheel fastening swing bolts.	Pinned in hinges.	
4	4	Wearing plates.	Riveted to chest.	
1	1	Step.	On rear of wagon.	
2	2	Top door frames.	Riveted to top door plate.	
4	4	Top door hinge, male, reinforces.	Riveted inside of chest.	
2	2	Top door plates.	Hinged to chest.	
1	1	Upper front door frame.	Riveted to upper front door plate.	
2	2	Upper front door hinges, male.	Riveted to chest.	
1	1	Upper front door plate.	Hinged to chest.	
1	1	Vise handle strap.	Secures vise handle.	
6	6	Weather strips (leather).	Riveted to doors.	
2	2	Wheels.	See nomenclature of parts of 6-inch howitzer carriage, model of 1908.	
2	2	Wheel fastenings.	do.	
2	2	Wheel guards.	Riveted to side rails.	
1	1	Wheel guard cross brace.	do.	
4	4	Wing nuts.	Secure lock bars.	
4	4	Wing nut clasps.	On lock bars.	
4	4	Wing nut pins, with—		
		Washers.	Riveted to chest.	
		Reinforces.	do.	
1	1	Left packing, consisting of—		
		Body.	Left end, upper rear compartment.	
1	1	Front packing.	do.	
1	1	Lunette transom bushing packing, consisting of—		
1	1	Back.	Right rear corner, upper rear compartment.	
		Bottom.	do.	
1	1	End (left).	do.	
1	1	End (right).	do.	
1	1	Front.	do.	
1	1	Packing "A".	Left front corner, upper rear compartment.	
1	1	Packing "B," consisting of—		
		Body.	Through middle, upper rear compartment.	
1	1	Steel angle.	do.	
1	1	Packing "C".	Between end of chest and packing "B," upper rear compartment.	
		Right packing.	Right middle, upper rear compartment	
1	1	Spare hub liner packing, consisting of—		
1	1	Body.	Left rear corner, upper rear compartment.	
		Bottom.	do.	
1	1	Front liner packing (middle).	do.	
2	2	Front liner packing (upper and lower).	do.	
1	1	Front (middle).	do.	
2	2	Front (upper and lower).	do.	
1	1	Rear liner.	do.	
1	1	Rear liner packing (lower).	do.	
1	1	Rear liner packing (middle).	do.	
1	1	Rear liner packing (upper).	do.	
1	1	Rear (middle).	do.	
1	1	Rear (upper).	do.	
15	1	Ribs.	do.	
1	1	Top.	do.	
1	1	Spare pintle and lunette packing, consisting of—		
1	1	Center piece.	Right end, upper rear compartment.	
1	1	End (rear).	do.	
1	1	Filler cleat (bottom).	do.	
1	1	Filler cleat (left).	do.	
2	2	Filler cleats (right).	do.	
2	2	Lunette blocks.	do.	
2	2	Outer pieces.	do.	
3	3	Partitions.	do.	
1	1	Side (left).	do.	
1	1	Side (right).	do.	

IV 9

DESCRIPTION OF THE BATTERY WAGON, MODEL OF 1908, AND STORE WAGON, MODEL OF 1908.

(Plate XIX.)

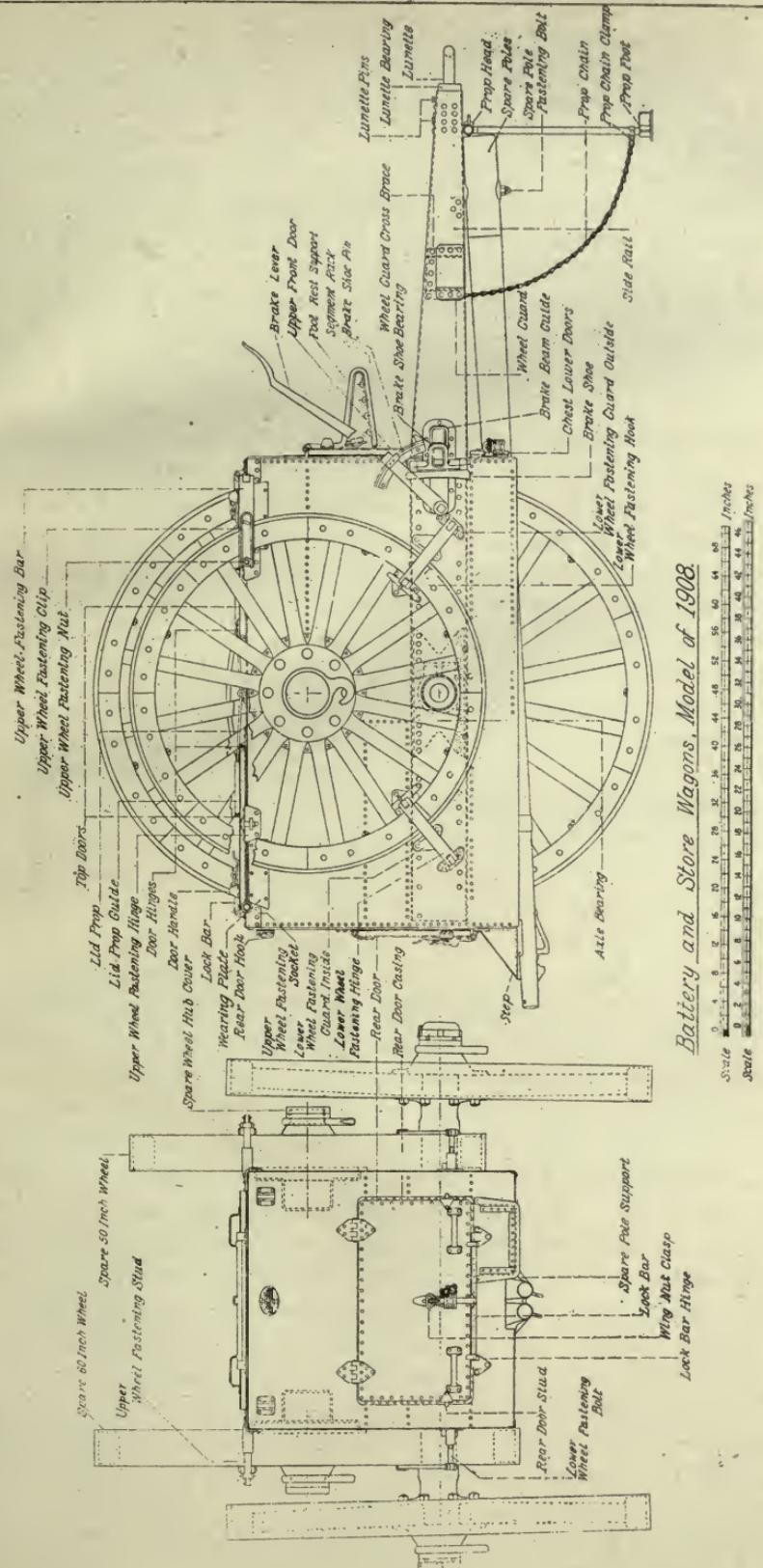
The battery wagon is a rectangular steel box on wheels, provided for the transport of battery tools and supplies, spare parts of guns, carriages and harness, materials for cleaning and preservation, etc. The store wagon is exactly similar to the battery wagon, except in such minor details as pertain to the packing of various pieces of equipment.

To bring the center of gravity as low as possible the axle of the battery wagon is made to pass through the chest.

The frame consists of two side rails of channel section, with flanges turning inward running parallel inside the sides of the chest. The rails are riveted to the sides of the chest, fastened to the axle by suitable bearings, and are joined in front to secure the bracket for the lunette, the latter exactly similar to that on the connecting pole on the caisson. At the front of the chest the brake cross brace connects the side rails and at the proper distance from the lunette bracket the wheel cross brace stiffens the frame to withstand the impacts of the limber wheels in turning. A projection cast on the underside of the lunette bracket receives the hinge pin of a prop for use when the vehicle is unlimbered. The prop is formed of two steel tubes, united at the lower end by a bronze prop foot and at the upper end by the prop head. When not in use the prop is swung up under the spare poles and held in that position by chains leading from the prop legs through guides on the wheel-guard cross brace and uniting in a hook which is engaged over one of the button-like heads of the lunette pins.

The chest is built up of flange steel plates and divided into 10 compartments for the convenient disposal of the load. A vertical transverse partition divides all that part of the chest above the lower flanges of the side rails and strengthens the chest against stresses resulting from lurching. The space forward of this transverse partition is floored to form a compartment entered through a flanged opening in the top. The compartment beneath has a flanged opening in the chest front. The edges of these doorways are reinforced by steel angles; the doors are metal sheets with angle flanges faced with leather to shed rain water.

The space in rear of the transverse partition is floored, forming a compartment entered from the top. Underneath, a central space with door in the chest rear accommodates two tool boxes, and on each side of this are two shallow compartments for small articles, access to these being through handholes in the walls of the tool-box recess.



To permit the transport of two spare pole bodies underneath the frame that portion of the chest below the side rails is built with compartments on each side, leaving a central space. In this the poles are supported by suitable fastenings. The spare poles are carried only on the battery wagon. The lower side compartments are entered from the front, and may also be reached through apertures in the floor of the compartment for tool boxes. They are provided for transporting the spare counter-recoil springs of the carriages, which will occupy three of the four compartments of the two wagons. In the fourth may be carried spare sponge staves, shovel handles, or other long articles.

The doors of these lower compartments are hinged and fitted with hasps and padlocks.

The forward top door opens from the front and the rear top door from the rear; that on the chest front is hinged at its lower edge to open downward and that on the rear of the chest opens upward and is held in the open position by latches which engage studs on the door. These four larger doors are secured by lock bars with chained padlocks. Spring wing-nut clasps on the lock bars hold the wing nuts in place. The foot rest is secured to the upper front door, and a step for convenience in unloading the upper rear compartment is attached to the rear of the chest.

Upon each side of the chest are provided arrangements for carrying a spare wheel. A hole in the side of the chest and the spare wheel casing riveted around this hole on the inside of the chest receives the inner face of the hub, while the tire and felloe are clamped to the side by four wheel fastenings. Forged steel lugs are riveted to the chest body against which the tire of the spare wheel rests. Heavy metal straps are hinged to these, and passing outside the tire are secured in the lower fastenings by hasps to wheel-fastening hooks riveted to the chest and in the upper fixtures by swing bolts with lever nuts. To bring the center of gravity of the vehicle as low as possible the spare wheel is so placed that the wagon axle passes between its spokes. To remove a wheel from the fastenings, therefore, the wagon wheel must first be taken off. To secure proper clearance between the spare wheel hub and the spokes of the wagon wheel the spare wheel hub cap will not be carried on the spare wheel but in the battery-wagon chest and a special spare wheel hub cover put in its place to protect the threads of the hub box and exclude dirt. In the replacement of a damaged wheel it is probable that the original hub cap and wheel fastening may be used.

When speed is especially desirable in changing wheels the battery-wagon wheel may be taken to replace a broken one on a carriage, limber, or caisson, and the spare wheel assembled on the battery-wagon axle. The spare-wheel fastening will fit either the 50-inch

or 60-inch spare wheels. As issued three 60-inch and one 50-inch spare wheels are assembled in the fastenings of the two wagons.

A flange steel brake beam of box section passes through the side rails forward of the wheels and carries at each end a forged steel brake-shoe bearing with renewable cast-iron shoes to bear against the tires. The side rails at these points are reinforced by bronze brake-beam guides riveted on, which contain spring plungers to force the beam forward and away from the wheels. The brake is set by a lever on the right side of the chest, which operates through the brake shaft, brake crank, and brake connecting rod to draw the shoes against the wheels. The brake shoes are interchangeable with those of the carriage and caissons.

A strong vise is fitted to the right side rail of the battery wagon; it may be dismounted and carried in the chest if desired. For other articles carried see list of equipment to follow.

In loading a battery or store wagon the weight must be so distributed as to bring less than 105 pounds load on the pintle of the limber, as more will tend to make the pole of the limber rise.

For convenience the various compartments in the battery and store wagons are lettered and items in the tables of equipment marked to indicate the particular compartment in which they should be carried, in order that the weight at the pintle may be that desired. The following shows the lettering of the compartments.

Letter.	Position of compartment.	Letter.	Position of compartment.
A.....	Upper, rear.	F.....	Left, rear, intermediate.
B.....	Middle, rear.	G.....	Right, lower.
C.....	Right, rear, upper.	H.....	Left, lower.
D.....	Right, rear, intermediate.	J.....	Upper, front.
E.....	Left, rear, upper.	K.....	Intermediate, front.

DESCRIPTION OF SEVERAL TOOLS AND ACCESSORIES FOR THE BATTERY AND STORE WAGON.

Four chests containing tools and stores are carried in the rear compartments of the two wagons. They are a carpenter's tool chest, a saddler's chest, a chest for miscellaneous spare parts, and a chest for cleaning materials and small stores.

The carpenter's chest is an iron-bound wooden box containing an assortment of carpenter's tools so arranged that each tool may be taken from its place in the chest without removing any other. The saddler's chest, is a combined tool chest and stitching horse. For the latter purpose the chest forming the seat rests upon four hinged legs, cross braced to each other. The stitching clamp is secured in a socket on one end of the chest, while the door swinging open on the left side brings the tools into convenient reach of the saddler. For transportation the clamp is removed from its seat and placed within the

chest, the legs are folded over against each end and held by the leg braces, permitting the placing of the chest in a small compartment. Both the carpenter's and saddler's chests are provided with handles and locks and have sufficient capacity inside to take a canvas bag of small stores in addition to the articles given in the list at the back of this book. The chest for cleaning materials is a wooden box with hinged lid containing such perishable materials as sal soda, rotten stone, soap, tripoli, petrolatum, etc. The chest for miscellaneous spare parts holds various small stores for the artificer's use, such as nails, buckles, rivets, screws, tacks, etc.

One chest for a spare breech mechanism, one level chest containing a testing level, one chest for the engineer's reconnaissance outfit, and one chest for spare sights are issued to each battery; the latter contains provisions for the safe packing of one front and rear sight complete, one panoramic sight, and one set of bore sights.

CYCLOMETER.

One carriage limber in each battery is fitted with a device which registers the number of miles traveled. This instrument, called a cyclometer, is mounted on the limber axle near the left wheel and is composed of a star wheel and shaft actuating a train of gears, which bring figures representing 0.1 mile to 9,999.9 miles before a glass window in the usual manner of such meters.

A tally pin riveted to the wheel hub strikes the star wheel and moves it one tooth at each revolution of the wheel.

In assembling a tally pin on the wheel hub two $0.312\left(\frac{5}{16}\right)$ inch rivet holes must be drilled in the flange of the hub box 1.3 inches apart and 0.55 inch from the end of the hub. The dowel pinhole in the axle locating the cyclometer bracket is $21.437\left(21\frac{7}{16}\right)$ inches from the center line of the limber, $2.437\left(2\frac{7}{16}\right)$ inches from the shoulder of the axle, and at an angle of 16° to the rear of a vertical plane through the center line of the axle.

Nomenclature of cyclometer parts:

- 1 bracket.
- 1 bracket strap.
- 2 bracket-strap bolts.
- 1 bracket bolt with nut and split pin.
- 1 cover.
- 4 cover bolts with nuts and split pins.
- 1 stop.
- 1 spring.
- 1 tally shaft.
- 1 tally pin.
- 1 washer (felt).
- 1 counter.
- 1 case (for counter).
- 4 case screws.

PADLOCKS AND BOLT SNAPS.

The padlocks furnished for each separate vehicle, as carriage, forge limber, battery wagon, store limber, or store wagon, excepting the limbers and caissons, will have keys interchangeable for all locks of that particular vehicle, but differing from all others.

Limbers and caissons are furnished with a lock, marked "AMMUNITION," which has only one key, these being universally interchangeable.

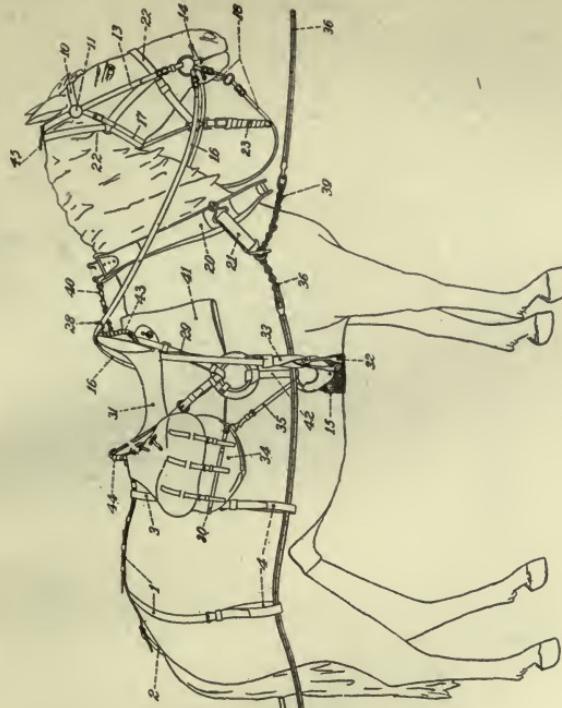
Bolt snaps for temporarily securing doors, etc., occur where no shot bolts are provided.

THE ARTILLERY HARNESS.

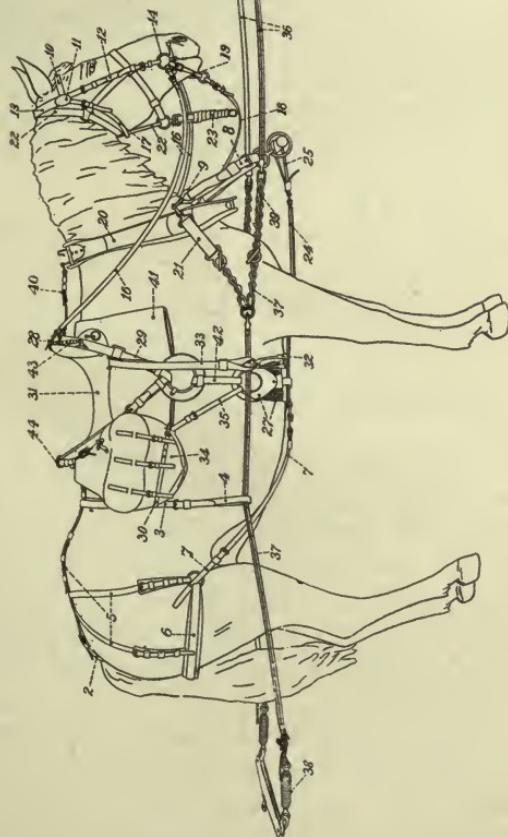
The component parts of the artillery harness are given in the table below. Plate XX shows the harness for the off-wheel and off-lead horses. The nomenclature corresponding to the numbers in the plate will be found in the table.

No. in plate.	Component parts.	Wheel.		Lead.		Property classification.	
		Near horse.	Off horse.	Near horse.	Off horse.	Class.	Section.
1-4	Backstrap and crupper, complete.....				1	1	
	Consisting of—						
1	Body and hip straps.....				1	1	
2	Crupper dock.....				1	1	
3	Loin strap.....				1	1	
4	Trace loops.....				4	4	
	Backstrap hook.....				1	1	
	Bellyband, complete.....				1	1	
	Consisting of—						
	Bellyband.....				1	1	
	Holding-down strap.....				2	2	
	Holding-down strap, loop.....				2	2	
8, 9	Breast strap, complete.....	1	1				
	Consisting of—						
8	Breast strap.....	1	1				
9	Breast-strap hooks.....	2	2				
2-7	Breechings, complete.....	1	1				
	Consisting of—						
5	Backstrap and hip straps.....	1	1				
6	Body.....	1	1				
2	Crupper dock.....	1	1				
	Backstrap hook.....	1	1				
	Side strap hooks.....	2	2				
3	Loin strap.....	1	1				
7	Side straps.....	2	2				
4	Trace loops.....	4	4				
10-19	Bridle, complete.....	1	1	1	1		
	Consisting of—						
10	Brow band.....	1	1	1	1		
11	Brow-band ornaments.....	2	2	2	2		
12	Cheek pieces.....	2	2	2	2		
18	Coupling strap.....	1				1	
19	Connecting strap.....	1				1	
13	Crown piece.....	1	1	1	1		
14	Snaffle bits ¹	1	1	1	1		
16	Reins (pairs).....	1	1	1	1		
17	Throat latch.....	1	1	1	1		
20	Collar, steel.....	1	1	1	1		
21	Hame tug (part of collar).....						
40	Collar strap.....	1	1	1	1		
22, 23	Halter, complete.....	1	1	1	1		
	Consisting of—						
22	Headstall.....	1	1	1	1		
23	Tie rope.....	1	1	1	1		
24, 25	Martingale, complete.....	1	1				
	Consisting of—						
24	Martingale.....	1	1				
25	Cincha strap.....	1	1				

¹ Twenty curb bits with chains are issued for use in place of snaffle bit on fractious draft horses.

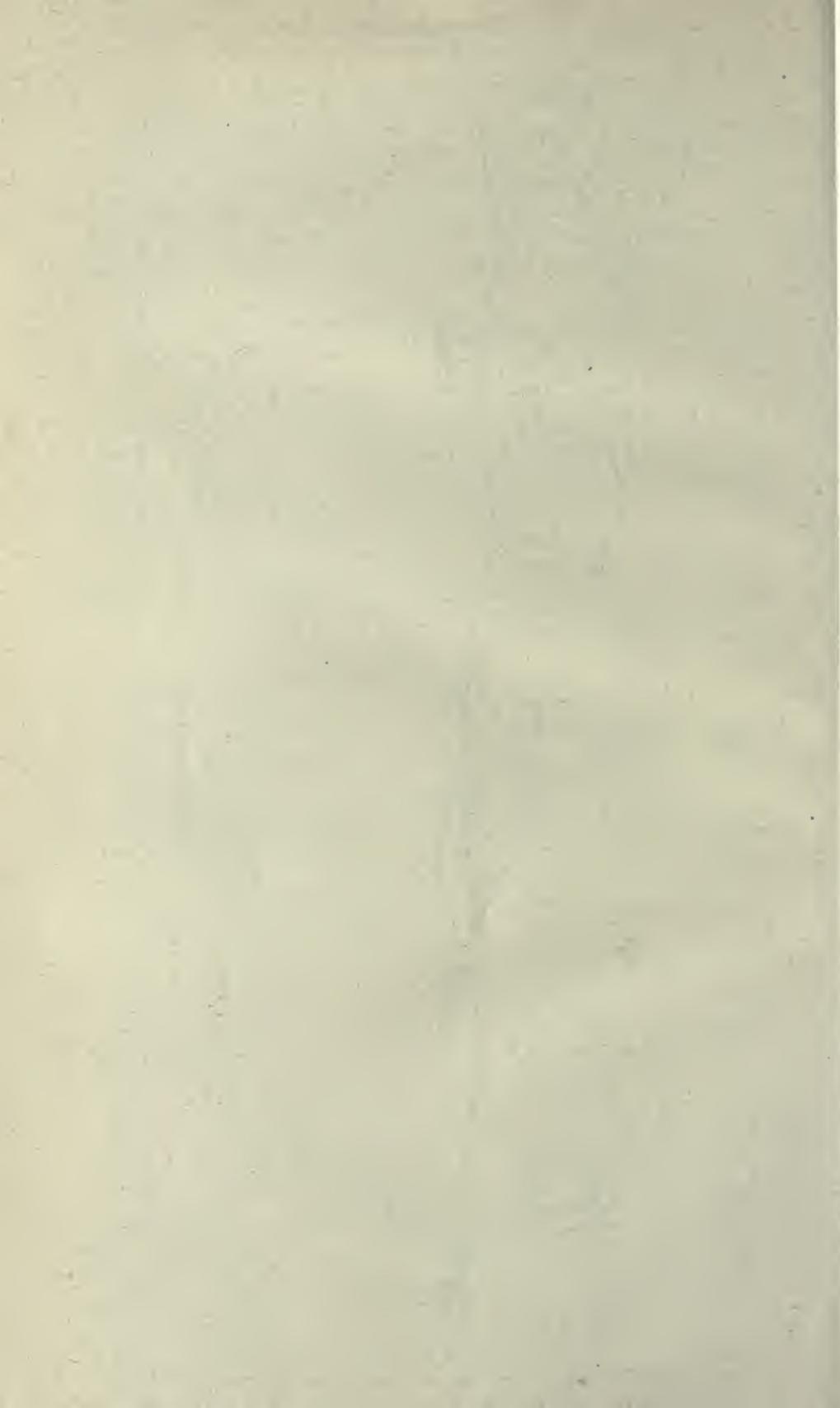


Off Lead Harness.
Showing new model bridle



Off Wheel Harness
Showing old model bridle

Artillery Harness



No. in plate.	Component parts.	Wheel.		Lead.		Property classification.	
		Near horse.	Off horse.	Near horse.	Off horse.	Class.	Sec- tion.
26, 33	Saddle, complete.....	1	1	1	1		
	Consisting of—						
27	Cinchas with reinforces and loops.....	1	1				
15	Cinchas without reinforces and loops.....			1	1		
28	Lead rein roller and strap.....		1		1		
29, 42	Quarter straps, including rings, safes, and cincha straps.....	1	1				
43	Coat strap, 33-inch (pommel).....	3	2	3	2		
44	Coat strap, 45-inch (cantle).....	1	1	1	1		
30	Coat strap, 60-inch.....		2		2		
31	Saddletree, leather covered.....	1	1	1	1		
32	Stirrup (nickel steel).....	2	2	2	2		
33	Stirrup straps.....	2	2	2	2		
34	Saddlebags, pairs.....		1		1		
35	Saddlebags side straps.....		2		2		
36	Traces, lead, model of 1908.....			2	2		
	Each consisting of—						
	1 trace body.....						
	1 trace cover.....						
	3 links.....						
	1 chain.....						
	1 toggle.....						
	2 sockets.....						
	2 cones.....						
	2 filler pieces.....						
37	Traces, wheel, model of 1908.....	2	2				
	Each consisting of—						
	1 trace body.....						
	1 trace cover.....						
	1 ring.....						
	2 sockets.....						
	2 links.....						
	2 chains.....						
	2 toggles.....						
	2 cones.....						
	2 filler pieces.....						
38	1 Mogul spring.....						
	1 loop hook.....						
	1 ring.....						
	1 Mogul spring loop.....						
	1 locking strap.....						
39	Trace chains.....					2	2
	Whip.....	1				1	
41	Sweat leathers.....	2				2	
	Blanket, issued separately from harness.....	1	1			1	

STEEL COLLARS.

(Class IV, Section 8.)

SIZES AND DIRECTIONS FOR FITTING.

Steel collars are made in the following sizes: 2A, 2B, 4A, 4B, 5, 5A, 5B, 6, 6A, 6B, 7, 7A, 7B, and 8A. The number and shape of the collar are stamped on the front side under the extension bolt. The A and B shapes have straighter sides than the numbers without letters. When issued with harness, unless otherwise ordered, 20 per cent of the collars are No. 4A, 30 per cent No. 5, 40 per cent No. 5A, and 10 per cent No. 6. In requisitions, the size of collars desired should be given.

The steel collar pads are made in seven different sizes: No. 0 is 4 inches wide, No. 1 is 4.5 inches wide, No. 2 is 5 inches wide, etc., to No. 6, which is 7 inches wide. The pad connections are also furnished in seven sizes, from No. 0 to No. 6. For the plain number

of collar (5, 6, or 7), the regular adjustment requires a pad connection of the same number as the pad. The A and B shapes have straighter sides and take a pad connection two sizes larger than the pad—that is, it would take a No. 3 connection with a No. 1 pad, etc., for the regular adjustment in these shapes. When the collar is very wide at the top and narrow at the bottom, the size of the pad connection must be increased one or two numbers to allow the collar to close easily at the bottom. In the reverse case a smaller pad connection should be used. The collar pads are numbered on the front inner side. The pad connections are numbered on the side having the round holes, which side must be kept to the front on the collar. In requisitions for collar pads and pad connections the sizes desired must be stated.

The buckle is made in two sizes. No. 2 is 1 inch longer than No. 1 and is used with the larger sizes of collar pads.

The correct adjustment and fitting of collars is of the utmost importance. The variety of sizes and shapes of collars, pads, pad connections, and buckles issued by the Ordnance Department is sufficient to enable any horse to be correctly fitted. Efficient supervision by officers of the fitting of collars and of the adjustment of the point of draft (trace plate) is required to secure proper results.

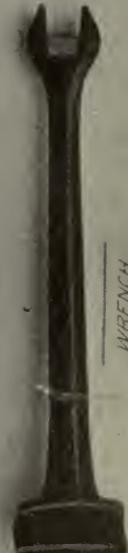
Table of dimensions.

Number of collar.	Size of collar fitted with No. 3 pads.				Size of collar fitted with No. 1 pads.			
	Length of collar inside.	Width 6 inches down from top.	Width 8 inches down from top.	Width at draft.	Length of collar inside.	Width 6 inches down from top.	Width 8 inches down from top.	Width at draft.
2A.....	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
2A.....	18	6 $\frac{1}{2}$	7 $\frac{1}{2}$	8 $\frac{3}{4}$	16 $\frac{1}{2}$	5 $\frac{1}{2}$	5 $\frac{1}{2}$	7
2B.....	18	6 $\frac{1}{2}$	6 $\frac{1}{2}$	8	16 $\frac{1}{2}$	4 $\frac{1}{2}$	5 $\frac{1}{2}$	6 $\frac{3}{4}$
4A.....	19 $\frac{1}{2}$	7	7 $\frac{1}{4}$	8 $\frac{3}{4}$	18	5 $\frac{1}{2}$	6 $\frac{1}{2}$	7 $\frac{1}{2}$
4B.....	19 $\frac{1}{2}$	6 $\frac{1}{2}$	7 $\frac{1}{4}$	8 $\frac{3}{4}$	18	5 $\frac{1}{2}$	5 $\frac{1}{2}$	7 $\frac{1}{2}$
5.....	21	7 $\frac{1}{2}$	8 $\frac{3}{4}$	9 $\frac{1}{2}$	19 $\frac{1}{2}$	6 $\frac{1}{2}$	7 $\frac{1}{2}$	8 $\frac{1}{2}$
5A.....	21	7	7 $\frac{1}{4}$	9	19 $\frac{1}{2}$	5 $\frac{1}{2}$	6 $\frac{1}{2}$	7 $\frac{1}{2}$
5B.....	21	6 $\frac{1}{2}$	7 $\frac{1}{4}$	8 $\frac{1}{2}$	19 $\frac{1}{2}$	5 $\frac{1}{2}$	5 $\frac{1}{2}$	7 $\frac{1}{2}$
6.....	22 $\frac{1}{2}$	7 $\frac{1}{2}$	8 $\frac{3}{4}$	9 $\frac{1}{4}$	21	6 $\frac{1}{2}$	7 $\frac{1}{2}$	8 $\frac{1}{2}$
6A.....	22 $\frac{1}{2}$	7	7 $\frac{1}{4}$	9 $\frac{1}{2}$	21	6	6 $\frac{1}{2}$	8 $\frac{1}{2}$
6B.....	22 $\frac{1}{2}$	7	7 $\frac{1}{2}$	9 $\frac{1}{2}$	21	5 $\frac{1}{2}$	6 $\frac{1}{2}$	8 $\frac{1}{2}$
7.....	24	7 $\frac{1}{2}$	8 $\frac{3}{4}$	10 $\frac{1}{2}$	22 $\frac{1}{2}$	6 $\frac{1}{2}$	7 $\frac{1}{2}$	8 $\frac{1}{2}$
7A.....	24	7	7 $\frac{1}{2}$	9 $\frac{1}{2}$	22 $\frac{1}{2}$	5 $\frac{1}{2}$	6 $\frac{1}{2}$	8 $\frac{1}{2}$
7B.....	24	7	7 $\frac{1}{2}$ $\frac{1}{6}$	10	22 $\frac{1}{2}$	5 $\frac{1}{2}$	6 $\frac{1}{2}$	8 $\frac{1}{2}$
8A.....	25 $\frac{1}{2}$	7	7 $\frac{1}{4}$	9 $\frac{1}{4}$	24	5 $\frac{1}{2}$	6 $\frac{1}{2}$	8 $\frac{1}{2}$

The table of dimensions gives the largest and smallest size that each collar can be made with the No. 3 and No. 1 pads. Adding one-half inch in length and width to the smallest dimensions given in the table will give the size of the collars when fitted with the No. 2 pads. These examples are given to show the three regular adjustments in each size of collar, but these dimensions can be varied to suit the different shapes of necks. The largest pad can be put in the top of the collar and the bottom taken in to its smallest dimensions, or the



COLLAR STRAP



WRENCH



COLLAR PAD CONNECTION



BUCKLE LATCH



DRAFT SPRING



COLLAR PAD



BUCKLE SPRING



TRACE PLATE

BOLT AND NUT FOR TOP CONNECTION

BOLT AND NUT FOR BOTTOM OF COLLAR

PAD BOLT AND NUT

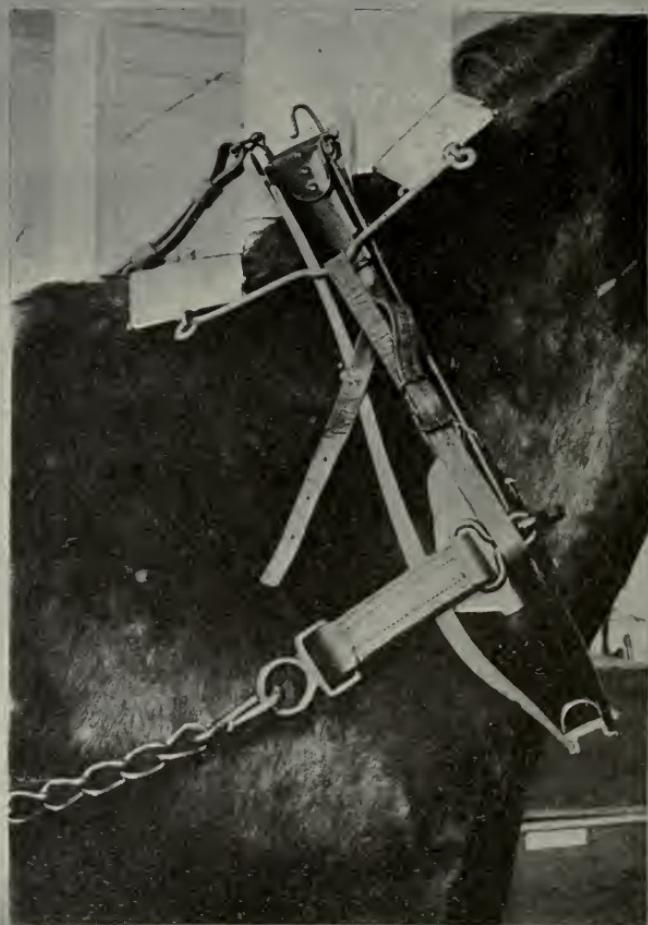
BOLT AND NUT FOR TRACE PLATE

BOLT AND NUT FOR EXTENSION

BUCKLE SPRING

TRACE PLATE

COLLAR BACK STRAP CONNECTION



Collar Lifting Device.

smallest pad can be put in the top and the bottom left out. While each collar can be lengthened or shortened and taken in or let out at the bottom by means of the adjustments provided, the width at the top can not be changed without using a larger or smaller pad.

In fitting irregular shapes none of the connections may give just the proper tension on the pad. In such a case use the one that comes nearest and straighten or bend the extension at the top. When the collar requires to be widened at top to relieve the pressure on the pad and make it lock easily at the bottom, open the collar wide and place a round piece of hard wood or iron, 1 inch in diameter and 2 inches long, between the connection and collar side close up to the hinge, then press the sides together and bend both sides alike, so that they will be the same length at the bottom. Do not let the fulcrum rest on the pad, for it will bend it. If the collar sides require straightening to close them tighter on the pad and give more tension on the latch at the bottom, open the collar at the bottom, hook the wrench over the top of collar side, and press down the lever, treating both sides alike. Both of these operations can be performed with the collar put together.

The spare parts furnished for the repair of the collars, with the correct names of the parts, are shown on Plate XXI.

Canvas collar pads are not part of the artillery harness, but are furnished upon requisitions. They are made in sizes Nos. 2, 3, 4, 5, and 6, as called for; if no size is called for, they are made in equal proportions of Nos. 4, 5, and 6.

COLLAR-LIFTING DEVICE.

(Plate XXII.)

This is a simple device for lifting the steel collar from the horse's neck, when, for any reason, the neck becomes sore. The straps securing it to the hame tugs afford easy attachments to or removal from the collar. By supporting the collar by canvas pads in front and in rear of the collar, the pressure is removed from the surface of the neck directly beneath the collar, and the weight is more evenly distributed along the neck. In case of necessity, such a device made by the organization mechanic, will allow working a horse when suffering with a sore neck.

THE CARE AND PRESERVATION OF LEATHER.

Attention is invited to the following:

"It is forbidden to use any dressing or polishing material on the leather accouterments or equipments of the soldier, the horse equipments for cavalry, or the artillery harness except the preparations supplied by the Ordnance Department for that purpose." (A. R. 293 of 1910.)

REASON FOR OILING LEATHER.

Leather, as it comes from the tannery in manufacture, is hard, rough, brittle, inflexible, and readily absorbs water. To remove these undesirable qualities and render the leather soft, pliable, flexible, and impervious to water, to increase the strength and toughness of the fiber, and to give the leather such a surface color and finish as will make it most sightly and suitable for the purpose for which intended, the manufacture is continued by hand stuffing it with a dubbing made of pure cod-liver oil and tallow, which the experience of curriers has shown to be the best material for this purpose. This dubbing is thoroughly absorbed by the leather, penetrating it completely, and is not merely limited to the surface.

The russet leather now used by the Ordnance Department in the manufacture of all leather equipments is pure oak tanned, of No. 1 tannage and finish, hand stuffed with a light dubbing made of pure cod-liver oil and tallow to preserve the leather, the dubbing being so sparingly used that the oil will not exude. This leather as it comes from the manufacturer contains enough oil to materially improve its quality and prolong its life, but not enough oil to soil the clothing if the equipment is properly cared for. No oil whatever is added to the leather in the manufacture of the equipments at the Government arsenals.

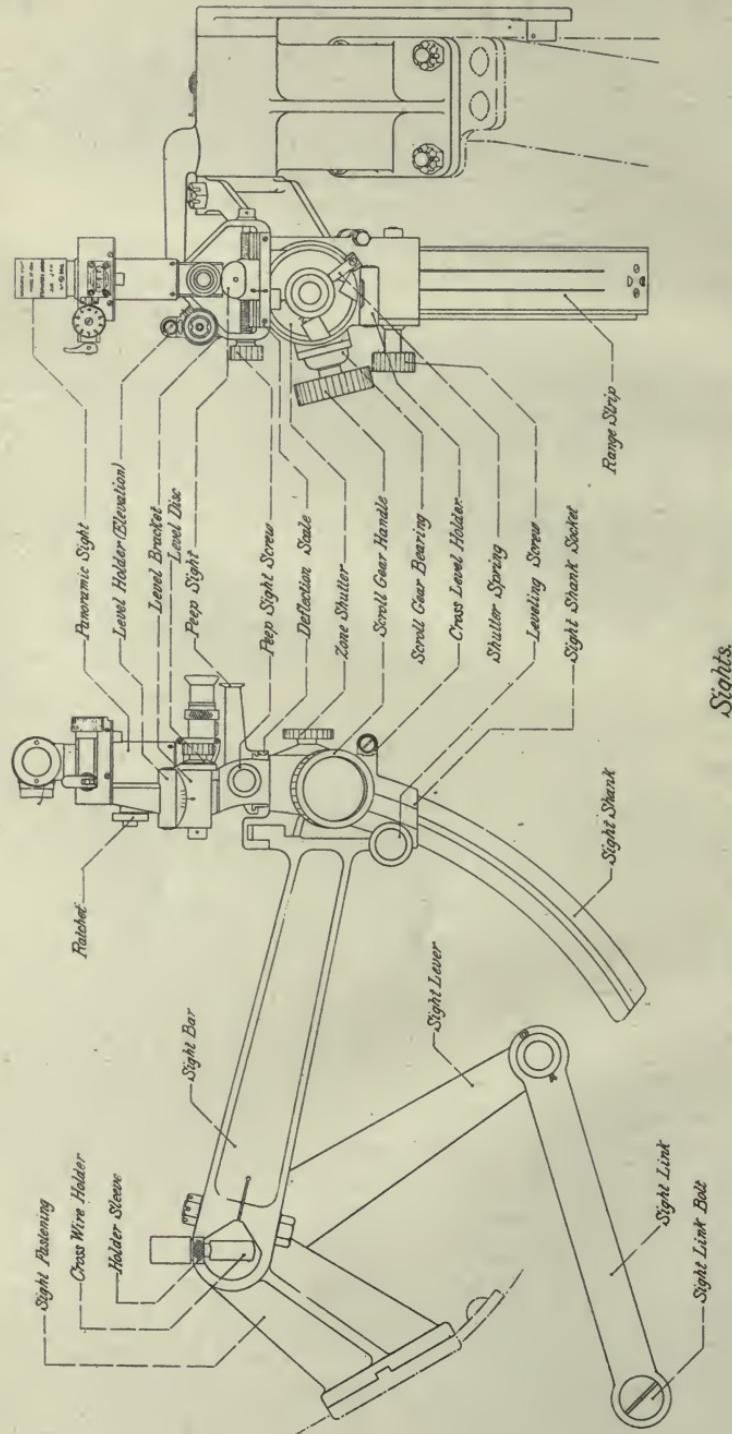
CARE OF RUSSET LEATHER.

Leather equipments which have become wet should be dried in the shade. Wet leather exposed to the direct rays of the sun or to the heat of a stove or radiators becomes hard and brittle.

When russet-leather equipments become soiled in service they should be cleaned by carefully washing the leather with a sponge moistened with a heavy lather made of clean water and castile or Frank Miller's soap, and then rubbing vigorously with a dry cloth until the leather is completely dry.

If the leather becomes harsh, dry, and brittle from exposure to water or other causes, clean as above described, and while the leather is still slightly moist apply an exceedingly light coat of neat's-foot oil by rubbing with a soft cloth moistened (not saturated) with the oil. If it is found that too much oil has been used, the surplus can be readily removed by rubbing with a sponge moistened with naphtha or gasoline. But these oils are not issued for this purpose.

Where a polish is desired, the leather should first be thoroughly cleaned and then the leather polish or dressing supplied by the Ordnance Department should be applied sparingly and thoroughly rubbed in with a soft, dry cloth. Scars, cuts, or abrasions of the leather may be improved in appearance but not obliterated by similar use of the leather polish.



Russet leather may be cleaned, oiled, and polished as described above, but it should be noted that if more than a light coat of oil be given, the leather will be greatly darkened and will quickly soil the clothing. No method of cleaning will restore the original light color of the leather or remove stains or discolorations.

CARE OF BLACK LEATHER.

To clean and dress black leather, wash it in water (lukewarm preferred) with Castile soap. An old horse brush will be found very satisfactory for applying the soap and water. Dry in the shade; when almost dry, apply the blacking, rubbing it in thoroughly.

Dry in the shade and then apply neat's-foot oil with a sponge or rag, rubbing in well until the leather is soft and pliable.

When dry, a certain amount of oil and blacking will exude from the leather; this should be rubbed off with a dry cloth.

SIGHTS.

OPEN OR TANGENT SIGHT.

(Plate XXIII.)

The parts for sighting and laying the piece include an open or tangent sight, consisting of a peep sight in rear with a corresponding front sight carrying cross wires and a panoramic sight.

A sight fastening having a bore parallel to the center line of the cradle trunnion is keyed and bolted to the left trunnion bracket. The bore in the sight fastening acts as a seat for a shank on the sight lever, the outer end of the shank being clamped to the sight bar. The other end of the sight lever is fastened to the sight link which is secured to the left rocker. Lines in the plane of rotation joining the centers of the cradle trunnions, sight link bolt, joint between sight link and sight lever, and bore of the sight fastening form the sides of a parallelogram which insure equality of angular movement of the sight bar and rocker in elevation.

This sight fastening has also an arm on which is located the front sight. The front sight consists of two cross wires set at an angle of 45° to horizontal in the circular bore of the cross-wire holder and held in place by the cross-wire ring and the cross-wire retainer. The shank of the holder is threaded with 32 threads per inch, which allows it vertical movement in the holder sleeve. The outside of the holder sleeve is threaded with 30 threads per inch, which allows it a vertical movement in the sight-fastening arm.

A $\frac{1}{8}$ -inch split pin passes through the arm and through slots in the cross-wire holder and holder sleeve, and fixes the cross-wire holder in a plane normal to the line of sight, the slots allowing vertical adjustment by the differential threads of the sleeve.

The sight bar which is secured to the sight-lever shank extends to the rear and supports the peep and panoramic sights.

The rear end or head of the sight bar is provided with circular guides cut with the line of sight, howitzer, at 0° elevation, as an axis, and upon these guides a socket for the sight shank is mounted. A clip formed on the lower end of the shank socket forms a bearing for a leveling screw, whose threads engage worm-gear teeth cut in the lower guide of the sight bar. Turning the leveling screw rotates the sight-shank socket about the line of sight and in a plane perpendicular to it. This permits the sight shank to be brought vertical, thereby correcting for any difference in the heights of the wheels due to inequalities of the ground.

The sight shank is an arm curved to the arc of a circle of which the bore of the sight fastening is the center; it slides in guides in the shank socket and is moved up and down in elevation by a scroll gear seated in a boss upon the shank socket and engaging in a rack cut upon the left side of the shank. The scroll gear is held in mesh with the rack by the scroll-gear spring and the scroll-gear lock. The sight shank may be dismounted from the sight-shank socket, or a considerable change in elevation may be quickly effected by releasing the scroll-gear lock, pulling the scroll-gear handle to compress the spring and disengage the scroll gear from the rack, and then sliding the sight shank through the shank socket by hand.

A German silver range strip fits in a dovetailed seat cut in the rear face of the sight shank, and is divided into three range scales, each graduated in yards to correspond to the ranges of the particular zone used. Mounted upon a trunnion on the rear face of the sight shank socket is a notched zone shutter, the notches being so arranged that only the range scale to be utilized is exposed. The knurled knob is used for turning the zone shutter to the desired zone, in which position it is held by a tooth of the shutter spring engaging a notch in the shutter. Raised figures on the shutter indicate the number of the zone of the range scale being read.

A shank socket cover is provided to close the inner side of the shank socket. A spring plate attached to the front of shank recess in the socket supports two plungers which are actuated by springs to force the shank against the rear wall of the socket, thus taking up the play of the parts.

The upper part of the sight shank is fashioned into a deflection guide and mounting for the peep sight and is prolonged to form a support for the panoramic sight. The peep-sight guide is located in an opening in the sight shank and is perpendicular to the line of sight. The peep sight is secured by clips to this guide and is traversed along it by the peep-sight screw. The latter passes through a tapped hole in the peep sight and is supported at each end in bearings in the sight shank. The screw is turned by a knurled head at its left end. The peep hole is 0.125 inch in diameter.

The deflection scale is attached to the rear face of the peep-sight guide and the index for the scale is on the peep sight. The graduations are in *milliemes*, or points equivalent to one one-thousandth part of the range. There are 45 mils upon each side of the zero, and the scale is marked from left to right as follows:

40	30	20	10	0	90	80	70	60
----	----	----	----	---	----	----	----	----

the actual mils being

40	30	20	10	0	6390	6380	6370	6360
----	----	----	----	---	------	------	------	------

thus making deflection readings on this sight uniform with those of the panoramic sight and the battery commander's telescope. The scale has a short longitudinal adjustment by which the zero of the scale may be located so as to bring the line of sight parallel to the plane containing the axes of howitzer and cradle.

The sides of the upper sight shank converge above the peep sight and form a support for the panoramic sight. This support has a vertical T slot into which the guide lug of the panoramic sight fits. A clamp screw with a ratchet head is seated in the support and holds the panoramic sight in position by forcing it against the ways of the support. A small spring plunger detent seated in the sight shank bears against the ratchet head of the clamp screw and fixes it in position.

Upon the left side of the upper sight shank is attached a level bracket, in which is mounted a level screw and an elevation level holder, the construction allowing the movement of the level holder through the arc of a circle in the vertical plane parallel to that of the sight shank. The amount of angular movement of the level holder is measured by the level scale, graduated on the level holder with an index on the level bracket, supplemented by a level micrometer disk on the level screw. The level scale is graduated in sixty-fourths of the circumference, and one complete turn of the screw moves the level holder through one of these divisions. The level micrometer disk on the level screw has 100 divisions, so that one of these divisions corresponds to 1 mil ($\frac{1}{1000}$ of the range). The divisions of the circular scale are marked 1 to 5 and in connection with the level disk are read 100, 200, etc., plus the indications of the latter. The 3 or 300 corresponds to the mean or zero position of the elevation-level holder.

This arrangement of graduated level serves the same purpose as the range quadrant on other carriages; it has the advantage that the sight and quadrant is combined in one instrument, thereby permitting the duties of laying for direction and elevation to be performed by one man. This probably slightly increases the time of laying, but permits the cannoneer on the right side to be free to operate the quick-return gear, firing handle, and breech block.

In firing, the sight is left in its seat.

THE PANORAMIC SIGHT, MODEL OF 1904.

(Class IV, Section 3.)

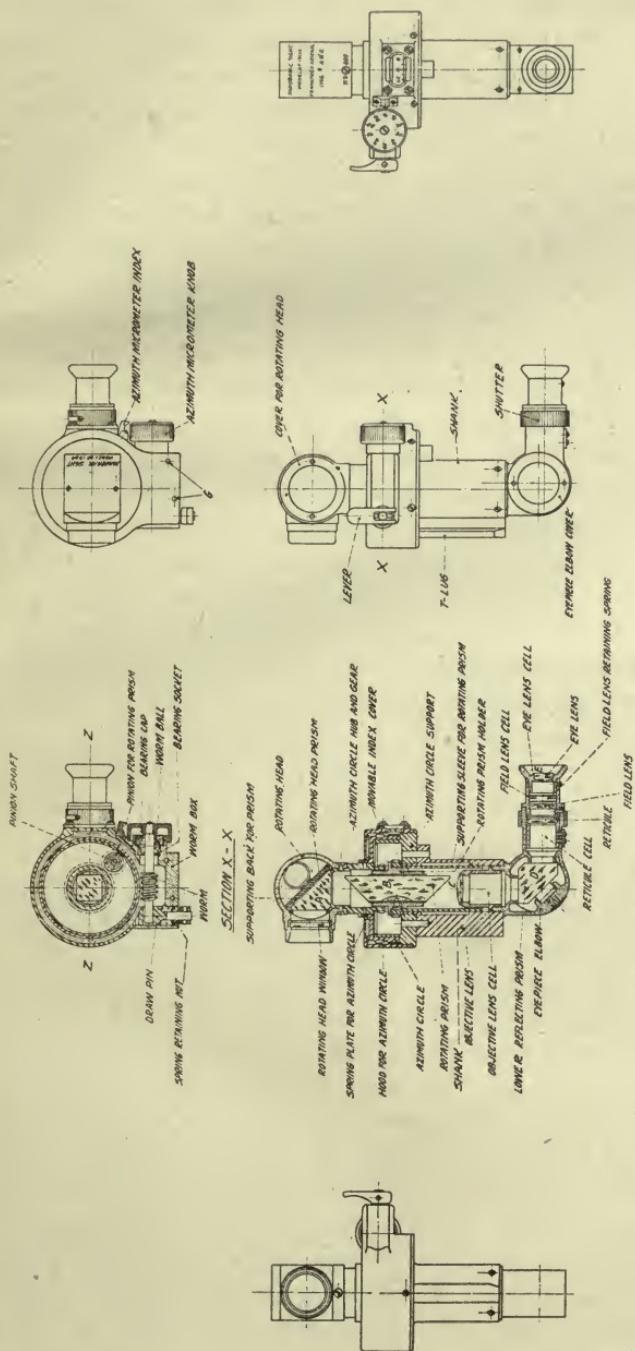
(Plate XXIV.)

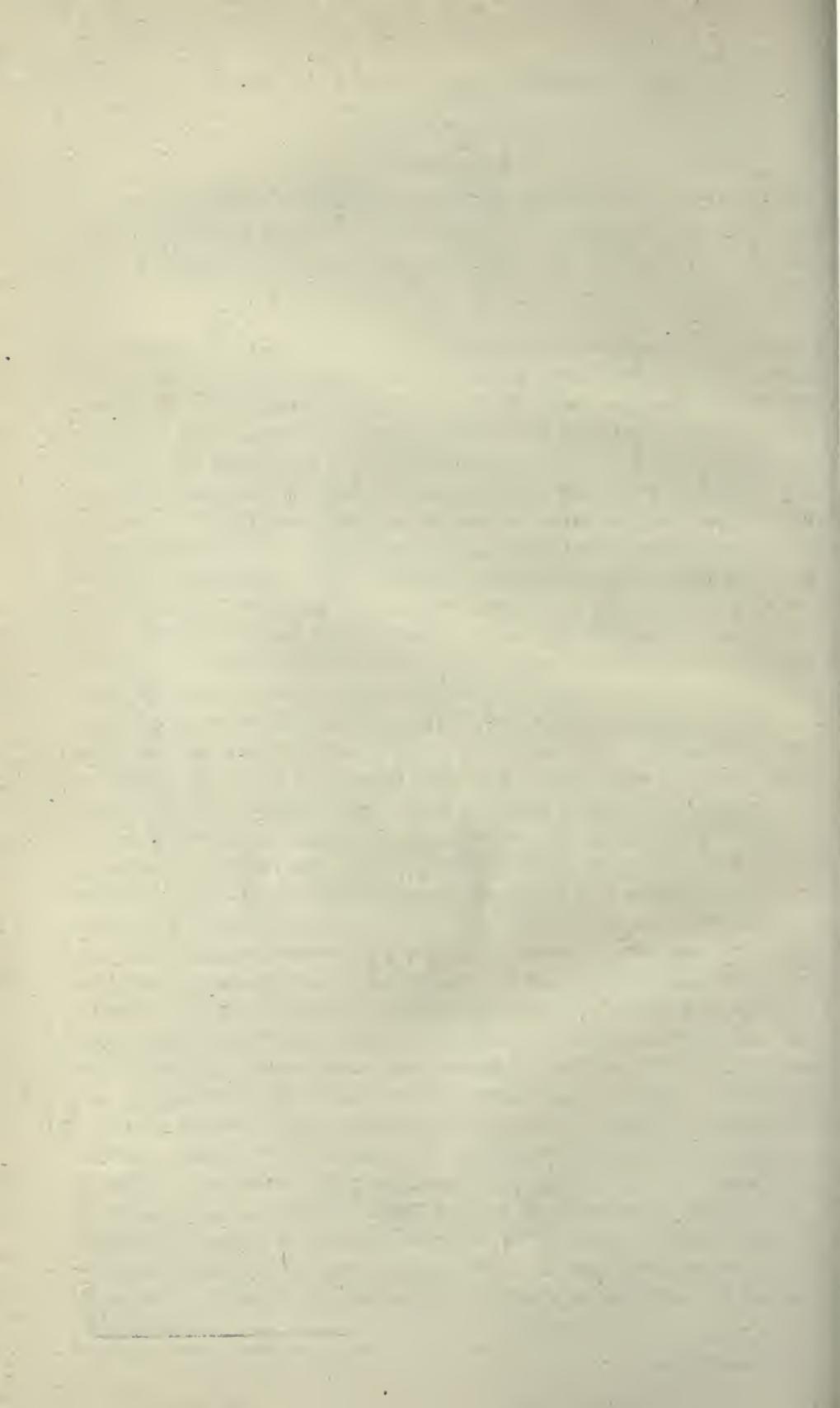
The panoramic sight is a vertical telescope so fitted with reflecting prisms that the gunner with his eye at the eyepiece, which is fixed in a horizontal position, may bring into the field of view an object situated at any point in a plane perpendicular to the axis of the telescope.

The details of the optical part of this instrument are shown in Plate XXIV, and comprise the rotating head prism A, the rotating prism B, the objective lens C, the lower reflecting prism D, and the eyepiece E. The rays coming from the object are reflected downward from the prism A into prism B, which rectifies them; after their passage through the objective lens C, the prism D reflects them in such a way that there is presented to the eyepiece E a rectified image, which the eyepiece magnifies. The prism B is of rectangular cross section. Its peculiarity is that on rotation about its longitudinal axis the image of an object seen through it turns with twice the angular velocity of the prism. As, therefore, the prisms A and B are so mounted as to rotate about this axis, prism B following A with one-half of the angular velocity of the latter, the image always remains as it would appear to one observing it directly with an ordinary terrestrial telescope.

The image formed by the objective lens would naturally be reversed and inverted. The lower inclined faces of the prism D by cross reflection transfer the rays to opposite sides of the axis, thus correcting the reversal. The correction of the inversion is accomplished by the combined action of the three prisms A, B, and D, the nature of the action varying with the different positions of the prisms. In the position shown on Plate XXIV prisms A and D act as parallel reflectors, and they without the lens system would present an erect image. Prism B, however, inverts the rays and corrects the inversion produced by the objective lens. It will be noted the effect would be the same whether the prism B occupies the position shown on the plate or be revolved 180° from that position. This latter position is the one it would assume if the prism A were rotated through 360° . If the prism A be now rotated through 180° , the prisms A and D would form two reflectors set at right angles and would give, without the lens system, an inverted image, and in conjunction with the lens system an erect image. Prism B in this case will occupy a position 90° from that shown on the plate, in which position it causes no inversion, but counteracts the inversion produced by prism D.

PANORAMIC SIGHT MODEL OF 1904





A glass reticule marked with cross lines is located in the focal plane of the instrument, with the intersection of the cross lines coincident with its optical axis. No provision is made for changing the focus of eyepiece or objective lens. As issued, the instrument is focused for the usual range and the average eye. The magnifying power of the instrument is four; the field of view is 10°.

The mechanical construction of the instrument is as follows: The body consists of a shank, provided on its front surface with a T lug, which fits into a corresponding slot in the head of the sight shank and is held in the position on sights by a detent, ratchet, and clamp screw. To the lower end of the body is screwed the eyepiece elbow, forming a housing for the prism D and the eyepiece E. The latter projects to the rear just above the peep of the rear sight. To the upper end of the shank is screwed the azimuth circle support, to which is screwed the hood for the azimuth circle, forming a seat for the rotating mechanism of the sight. The opening in the rotating head is closed by the rotating head glass window, which forms a dust guard. The rotating head prism A is mounted opposite this opening. The lower end of the rotating head is seated in the azimuth circle hub and gear. A worm located in worm box in the hood for azimuth circle engages in a worm gear cut on the azimuth circle. The worm is pivoted at its rear end in the worm box by a ball and socket bearing. This bearing consists of the bearing socket, worm ball, and bearing cap. The worm throw-out mechanism consists of the draw pin, draw pin spring, spring retaining nut and lever. The rotating prism B is secured in the upper end, and the objective C in the lower end, of the supporting sleeve for rotating prism resting in the hub and gear. The upper end of this supporting sleeve for the rotating prism and the lower end of the azimuth circle have gears which engage in a double pinion seated in the azimuth circle support. The gears and pinions are calculated so that the angular velocity of the rotating head is twice that of the rotating prism B and is in the same direction. The motion of rotation is transmitted from the worm to the azimuth circle, thence to the azimuth circle hub and gear, thence to the pinion, and through it to the supporting sleeve for rotating prism. The amount of motion of the rotating head prism is indicated by a graduated scale on the perimeter of the azimuth circle, visible through the glass azimuth circle window in the rear face of the hood for the azimuth circle. The zero of the scale and the index on the head-piece are located so that the line of sight of the panoramic sight is parallel to that of the rear sight, and consequently to the axis of the gun, when both sights are set at 0 elevation and deflection.

The scale is formed by dividing the circumference into 64 equal parts. One complete turn of the worm moves the rotating head

prism through one of these divisions, or $1/64$ of a circle. The rear end of the worm carries the azimuth micrometer knob with circumference graduated into 100 equal parts to form a micrometer scale. One of these subdivisions, therefore, equals $1/100$ of a division of the main scale or marks a movement of the rotating head prism and line of sight through $1/6400$ of a circle. An angular movement of the line of sight through $1/6400$ of a circle corresponds very closely to a lateral displacement of $1/1000$ of the range. Practically the subdivisions of the deflection scale on the panoramic sight are considered as points equal to $1/1000$ of the range and are called milliemes or mils.

The reading of the deflection scale or the size of an angle is given in the units of the micrometer scale as 2763, 1521, etc., meaning $2763/6400$, $1521/6400$, etc., of 360° . The alternate divisions of the main scale are numbered in a clockwise direction 0, 2, 4, etc., to 62, inclusive. In reading the deflection scale, therefore, hundreds are read directly from the main scales and tens and units from the deflection-screw micrometer scale. At 0 the line of sight is parallel to the vertical plane through the axis of the gun; at 16 (or 1,600 mils) it is perpendicular to that plane and pointing directly to the right, etc.

The azimuth micrometer knob is secured on the rear end of the worm by a locking screw. This arrangement permits the 0 of the scale to be set opposite the index line on the azimuth micrometer index without movement of the worm in adjusting the sight.

The worm, which is seated at its front end in the draw pin, is held in contact with the worm gear on the azimuth circle by the draw pin spring and is arranged so that it may be disengaged from the worm gear by movement of a lever. When disengaged the line of sight may be rapidly oriented to approximately the desired direction, the worm then thrown into gear, and finer adjustments made by turning the azimuth micrometer knob.

All panoramic sights have been made interchangeable, so as to fit in seats.

The following device for illumination of the cross lines of the reticule of panoramic sights is used:

A small slit is cut in the eyepiece elbow and the reticule cell on the side of the sight next the gun. A shutter is provided which encircles the eyepiece elbow opposite the slit, affording means for closing. On some sights this shutter is provided with a transparent celluloid window to prevent the entrance of dust. On the later sights a glass window is fitted in the side of the eyepiece.

For illumination at night electric flash lights are used. They should be held close to the illuminating slot or window.

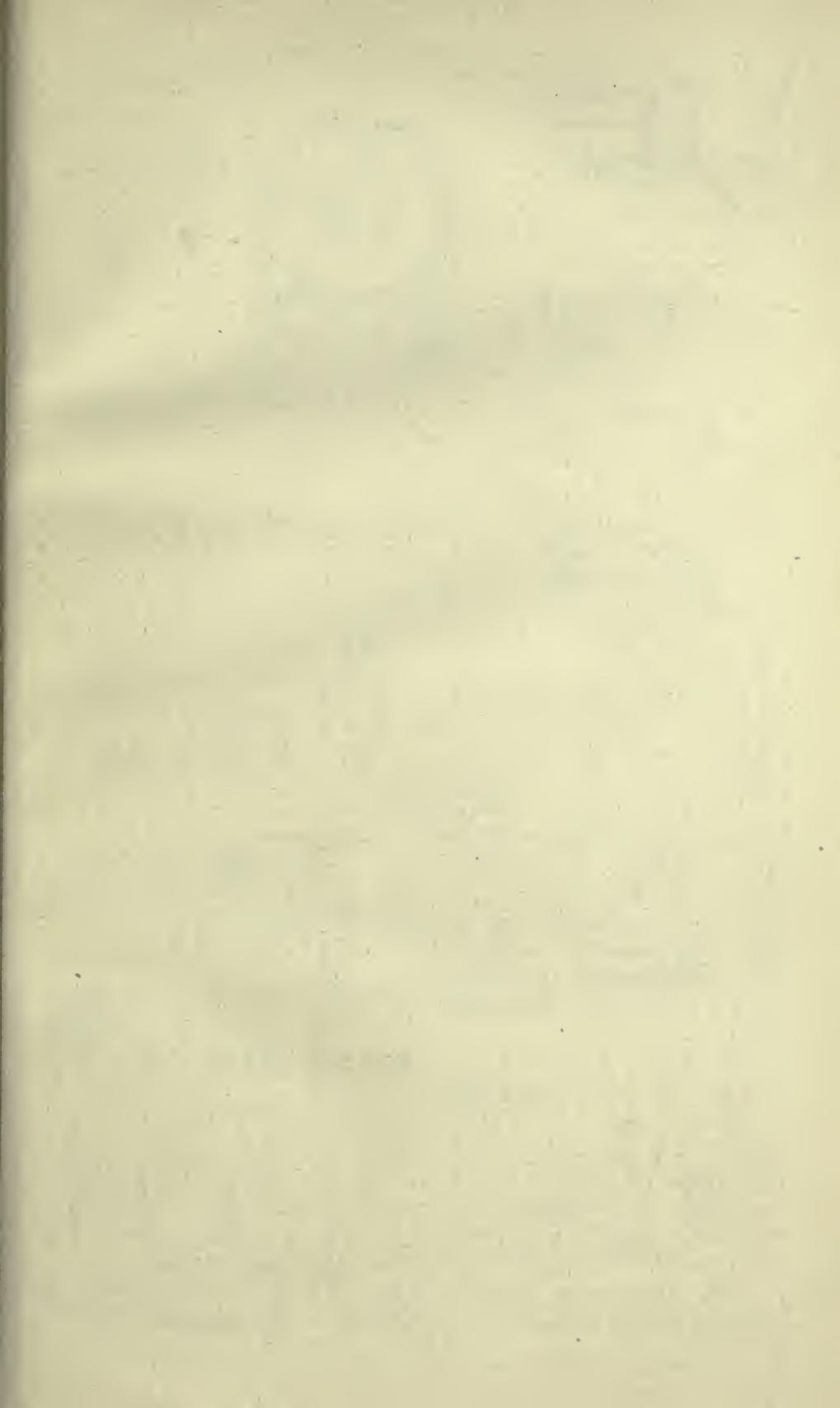
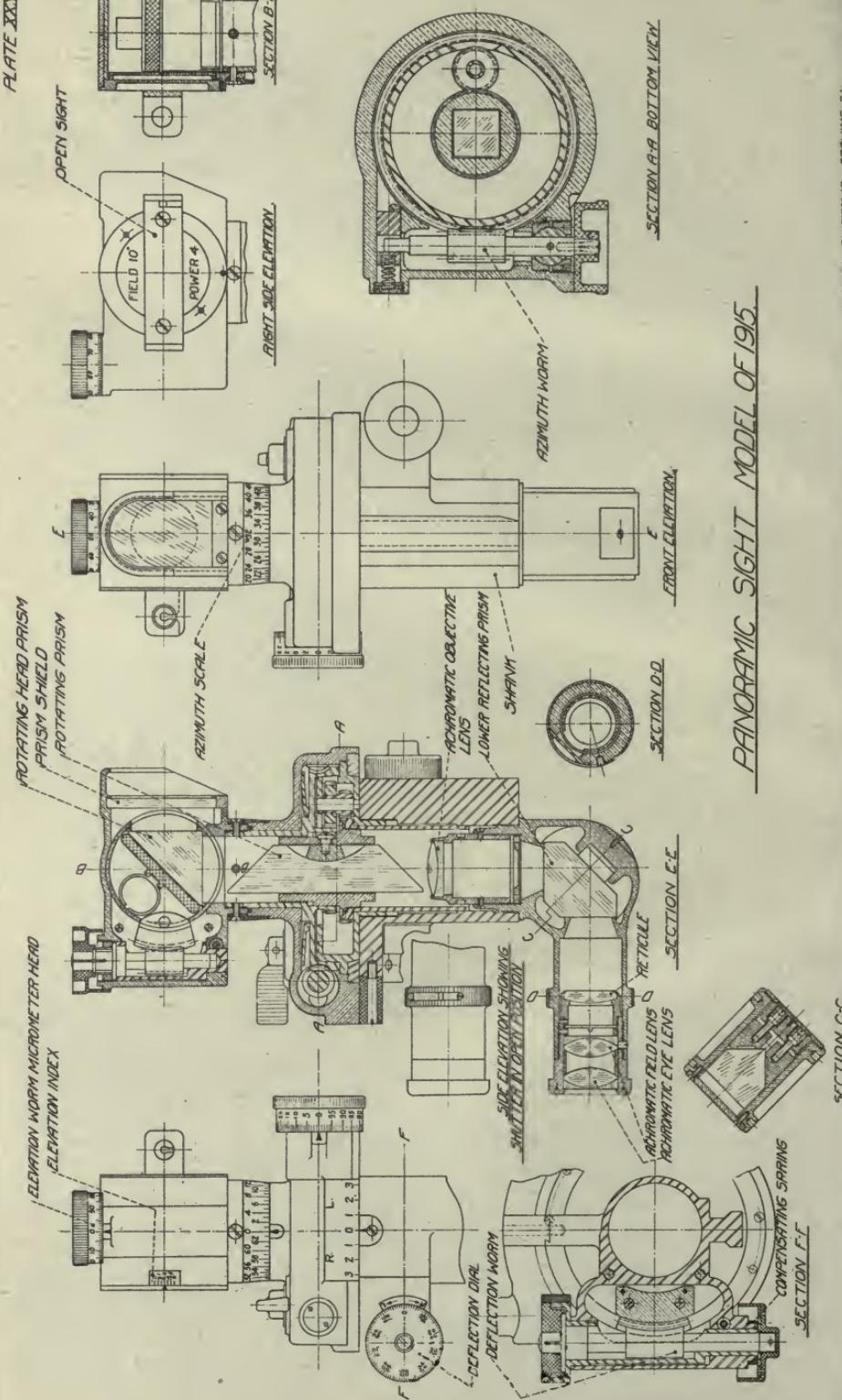


PLATE XXXV.



PANORAMIC SIGHT, MODEL OF 1915.

(Plate XXV.)

The panoramic sight is a vertical telescope so fitted with an optical system of reflecting prisms and lenses that the gunner with his eye at the fixed eyepiece in a horizontal position can bring into the field of view an object situated at any point in a plane perpendicular to the axis of the telescope.

The rays coming from the object are reflected downward from the rotating head prism into the rotating prism. The rotating prism rectifies the rays; after their passage through the achromatic objective lens, the lower reflecting prism reflects them in such a way that there is presented to the eyepiece a rectified image, which the eyepiece magnifies. The peculiarity of the rotating prism is that upon rotation about its longitudinal axis the image of the object seen through it turns with twice the angular velocity of the rotating prism. The rotating head prism and rotating prism are so mounted as to rotate about this axis, the rotating prism following the rotating head prism with one-half of the angular velocity of the latter; the image always remains as it would appear to one observing it directly with an ordinary telescope. The image formed by the achromatic objective lens would then be reversed and inverted. The rays are cross reflected to the opposite sides of the axis by the inclined faces of the lower reflecting prism, thus correcting the reversal.

The combined action of the rotating head prism, the rotating prism, and lower reflecting prism and the nature of action varying with different positions of the prisms, provide for the correction of the inversion of the image. The rotating head prism and lower reflecting prism, as shown in position on Plate XXV, act as parallel reflectors and they without the lens system would present an erect image. The rotating prism, however, inverts the rays and corrects the inversion produced by the achromatic objective lens. It will be noted that the effect would be the same whether the rotating prism occupies the same position shown on the plate or be revolved 180° from that position. The rotating head prism must be turned through 360° to get a position of 180° for the rotating prism. If the rotating head prism is rotated through 180° , the rotating prism and lower reflecting prism would form reflectors set at right angles, and would give, without the lens system, an inverted image, and in conjunction with the lens system an erect image. The rotating prism in this case will occupy a position 90° from that shown on the plate, in which position it causes no inversion but counteracts the inversion produced by the lower reflecting prism.

The instrument has a magnifying power of 4 and a field of view of 10° .

The principal parts of the panoramic sight are the rotating head mechanism, the elevation device, the azimuth mechanism, the rotating prism mechanism, the deflection mechanism, the shank, and the eyepiece.

The rotating head mechanism consists principally of the rotating head, rotating head prism, rotating head prism holder, prism holder cover, elevation index support, prism shield, and rotating head cover.

The rotating head forms a housing for its movable parts, and provides seats for the elevation-worm bushing and rotating head prism holder. The front opening of the rotating head is closed by the prism shield which forms a dust guard. The bottom threaded seat of the rotating head screws upon the upper end of the azimuth worm wheel and is locked in place by four azimuth scale retaining ring screws. Upon the rear face of the rotating head is engraved a scale which is used for measuring the elevation of the rotating head prism holder, which retains the rotating head prism and has an index mark upon the projection which coincides with the graduations of the elevation worm micrometer head.

The rotating-head prism is mounted within the rotating-head prism holder between the prism support front, prism support bottom, and prism support back, and secured in position by the rotating-head prism spring, which bears upon the prism support back. The rotating-head prism is protected on the right side by the prism-holder cover and on the left side by the elevation index support.

The prism shield is held within the rotating head by the prism shield retaining piece, which is in turn secured by two prism shield retaining piece screws.

The prism-holder cover screws into its threaded seat, located in the right side of the rotating-head prism holder and locked in position by the prism-holder cover screws.

The rotating head cover screws into its threaded seat, located in the right side of the rotating head and held in place by the rotating-head cover screws. The exterior of the rotating-head cover has two small holes for teat wrench, and engravings "Field 10°" and "Power 4" are located on the exterior surface.

The elevation-index support screws into its threaded seat, located in the left side of the rotating-head prism holder and secured in place by the elevation-index support screw. The small holes in the exterior surface allow the use of teat wrench to enable the elevation-index support to be screwed in place. The support retaining ring retains the elevation-index support with rotating-head prism holder within the rotating head, and is locked in position by the support-retaining ring screw.

The elevation index is held upon the elevation-index support by the two elevation-index retaining screws. The arrow engraved upon the German-silver piece, which is dovetailed in the elevation index, coincides with the graduations of the scale engraved upon the rear face of the rotating head.

The elevation device consists principally of the elevation segment, elevation worm, elevation-worm bushing, elevation-worm retaining nut, and elevation-worm micrometer head.

The elevation segment is held in its seat, provided in the rotating-head prism holder, by the segment lock pin. The movement of the elevation segment is limited between two dowel pins, which are driven through the rotating head.

The elevation worm is mounted eccentrically within the elevation-worm bushing, which when turned provides an adjustment to take up the wear between the worm threads and the worm teeth of the elevation segment.

The elevation-worm bushing has a screw-driver slot in its lower end, which is used for adjusting and is retained in position by the elevation-worm bushing clamp plug, which is secured by the bushing clamp plug screw.

The elevation-worm retaining nut retains the elevation-worm bushing and elevation worm lengthwise within the rotating head. The screw-driver slot in the top of the elevation-worm retaining nut is used for adjusting, and is locked in position by the elevation-worm retaining nut screw.

The elevation-worm micrometer head is held upon the upper slotted end of the elevation worm by the locking screw. The scale engraved upon the periphery is graduated into 100 equal divisions, numbered every 10 divisions. The upper exterior diameter of the elevation-worm micrometer head is straight knurled to facilitate turning. One complete revolution of the elevation-worm micrometer head is equal to the distance between each graduation upon the scale on the rear face of the rotating head.

The open sight is constructed of bronze plate, bent to shape having an arm projecting out at each end, each arm containing a hole. A bronze knee is soldered to the interior of the front projecting arm over the center of the hole in such a manner as to form a sight which is used for quick sighting. The open sight is secured to the rotating head cover by two open-sight retaining screws.

The principal parts of the azimuth mechanism are the azimuth-worm wheel, azimuth-worm wheel support, azimuth-worm wheel cover, azimuth worm, azimuth-worm ball, throw-out cam, throw-out plunger, azimuth-micrometer knob and azimuth scale.

The azimuth scale is retained upon its bearing, provided on lower end of the rotating head, by the azimuth-scale retaining ring which

in turn is secured by four azimuth-scale retaining ring screws. The four elongated holes in the azimuth scale provide for adjusting. The scale, engraved upon the lower, exterior diameter, is graduated into 64 equal divisions, numbered every 2 divisions.

The azimuth-worm wheel cover forms a housing for the movable parts of the azimuth mechanism and provides seats for the ball and socket bearing throw-out mechanism and deflection worm wheel and support ring. The arrow, engraved upon the upper exterior diameter of the azimuth-worm wheel cover, coincides with the graduations of the azimuth scale. The scale engraved upon a boss on the rear face of the azimuth-worm wheel cover is used for measuring the deflection of the object. The arrow, engraved upon the offset on the rear right side of the azimuth-worm wheel cover, coincides with the graduations on the azimuth-micrometer knob.

The felt washer which is retained in its seat, is located in the upper end of the azimuth-worm wheel cover, and provides for sufficient friction between the rotating head and the azimuth worm-wheel cover.

The azimuth-worm wheel support spring tends to retain the azimuth-worm wheel upon the azimuth-worm wheel support.

The gear teeth of the lower part of the azimuth-worm wheel mesh with the rotating head pinion, which upon rotation moves the rotating head mechanism. The lower part of the azimuth-worm wheel support screws into its threaded seat provided in the upper part of the shank.

The azimuth worm is provided at one end with an azimuth-worm ball, held in place by a bearing cap and bearing socket. A clearance space is provided so that the bearing cap can be adjusted to take up wear. A throw-out plunger with a spring and spring retaining nut, is provided for compensating for wear between the azimuth worm and azimuth-worm wheel. A throw-out lever which is pinned to a throw-out cam, which in turning acts on the throw-out plunger, is a means provided for disengaging the azimuth worm and azimuth-worm wheel. The azimuth-micrometer knob is held on the slotted end of the azimuth worm by the locking screw. The scale is divided into 100 equal divisions, numbered every 5 divisions. One complete revolution of the azimuth-micrometer knob is equal to the distance between each graduation on the azimuth scale.

The rotating-prism mechanism consists principally of the rotating prism, rotating-prism holder, rotating-prism supporting sleeve, rotating-prism pinion, and rotating-prism block.

The rotating prism is of rectangular cross section, mounted and retained in position within the rotating-prism holder by rotating-prism block, which is secured by the rotating-prism set screw. The rotating-prism holder is seated in the upper section of the rotating-prism supporting sleeve. The rotating-prism pinion is driven upon

the pinion shaft. The rotating-head pinion is driven upon the hub of the rotating-prism pinion. The pinion shaft is mounted at both ends in its seat provided in the azimuth-worm wheel support which upon rotation, moves the pinion shaft. This gear system is so designed that the rotating head moves twice the angular distance of the rotating-prism holder.

The principal parts of the deflection mechanism are the deflection worm wheel and support ring, deflection worm, deflection-worm bushing, deflection dial, and deflection-worm knob.

The deflection-worm wheel and support ring is seated within the azimuth-worm-wheel cover located by two dowel pins and then retained by six deflection-worm wheel and support-ring screws. A segment, projecting downward into the shank, carries a worm wheel which meshes with the deflection worm. The deflection-worm-wheel support is located within the shank and against the deflection-worm wheel and support ring by two dowel pins, and secured by two deflection-worm-wheel support screws.

The deflection worm is mounted eccentrically within the deflection-worm bushing which when turned provides an adjustment to take up the wear between the worm threads and the worm teeth of the deflection-worm wheel and support ring.

The deflection-worm bushing is adjusted by using the fingers upon the rear end and is restrained in position by the deflection-worm-bushing clamp plug which is secured by the deflection-worm-bushing clamp-plug screw. A German silver piece is pinned and soldered to the rear end of the deflection-worm bushing on which is engraved three arrows with letters "R" and "L". The middle or large arrow coincides with the graduations of the deflection dial. The compensating spring is provided for taking up all lost motion that appears lengthwise in the mechanism. The worm knob is secured to the deflection worm by a taper pin, the periphery being straight knurled to facilitate turning. The deflection dial is held on the front slotted end of the deflection worm by the locking screw. The scale engraved upon the front end is graduated into 100 equal divisions, numbered every 10 divisions. The shank forms a body for the instrument and provides seats for the azimuth-worm-wheel support, deflection-worm bushing, and elbow. The front surface is provided with a T lug which fits into a corresponding slot in the upper end of the shank of the rear sight. Upon the rear surface is dovetailed the deflection index which is retained in place by the deflection-index screw. The arrow engraved upon the deflection index coincides with graduations on the rear face of the azimuth-worm-wheel cover.

The eyepiece consists principally of the reticule, reticule cell, achromatic field lens, achromatic eyelens, and eyelens cell.

The achromatic objective lens is mounted in the upper end of the objective lens cell. This cell is secured in its threaded seat in the upper end of the elbow by two objective lens cell-retaining screws.

The elbow is screwed in the lower end of the shank and secured by the four elbow-retaining screws in such a manner that its projecting arm is horizontal to the axis of the instrument. The elbow provides seats for the lower reflecting prism and the eyelens cell. The lower reflecting prism is held upon its bearing surfaces, provided in the elbow by two wedges which in turn are secured by the two wedge screws. These screws are retained by the wedge screw-lock screw. The wedge-screw cover is provided to retain the wedge screw-lock screws in position. The wedge-screw cover is secured by the wedge-cover screw. The opening of the elbow upon the right and left sides are closed by the elbow covers, which are locked by the elbow-cover screws. Upon the left side of the elbow is an opening through which the light is thrown upon the reticule. This opening is covered by the window to protect the interior of the eyepiece from dust and dirt. The shutter is so designed to slide over the opening in the elbow, being guided by the shutter-stop screw and movement limited by the elongated slot.

The reticule has two crosslines etched on its surface and is mounted in the forward end of the reticule cell which is secured in the eyelens cell by the reticule cell-retaining screw.

The achromatic eyelens is mounted in the eyelens cell and is separated from the achromatic field lens by the lens separator. The achromatic field lens is held within the eyelens cell by the field lens retaining ring, which in turn is locked by the field-lens cell-retaining-ring screw. The eyelens cell is secured to the elbow by the eyelens cell-retaining screw.

All interior metallic surfaces exposed to the refracted light are finished with dull black baking enamel. All exposed optical elements, covers, and nonrotating joints are sealed with the litharge cement or equal. All German silver graduated surfaces are sand blasted and lacquered.

USE OF THE PANORAMIC SIGHTS, MODELS OF 1914 AND 1915.

For direct aiming.—Set the rear sight at the required elevation and correct for difference of level of wheels; set off the desired deflection on the azimuth circle of the panoramic sight; bring the cross lines of the sight upon the target by means of the elevating and traversing devices of the carriage. For imparting the approximate initial direction the line sight may be used with advantage.

In using the model of 1915 sight for direct fire, care must be taken that the rotating head be set at 300 mils and the deflection mechanism at 0.

For indirect aiming.—Set the rear sight at the required elevation and make correction for difference of level of wheels; set the azimuth circle of the panoramic sight at the deflection ordered. Lay the gun for deflection by directing the vertical line of the panoramic sight at the auxiliary aiming point, the elevation of the gun being given by using the range quadrant. The angle of deflection to be set off on the azimuth circle of the panoramic sight is the same as the angle made by joining the target and the auxiliary aiming point with the sight.

USE OF PANORAMIC SIGHT FOR MEASUREMENT OF RANGES.

Distances or ranges may be roughly calculated from readings made by two panoramic sights mounted on their guns, as follows:

Direct the guns on the target; then sight the panoramic sights on each other. The angle at the target subtended by the line connecting the two guns is then 3,200 mils minus the sum of the actual angles in mils measured at the guns.

If B is the distance between the guns in yards, then range equals B multiplied by 1,000 divided by the number of mils in the angle at the target.

The accuracy of this method increases as B becomes smaller, so long as the instruments can be read correctly.

USE OF SIGHTS.

The powder charges and sighting arrangements are prepared so that firings may be carried on in three different zones. The ranges for each zone extend from 0 to maximum range for the particular zone. As far as the sights are concerned they are used the same for each zone, the only precaution necessary being that the zone shutter for the rear sight must be set so as to permit reading the proper scale.

Rear sight.—When used in connection with the front sight its use is ordinarily limited to direct firing only. For this purpose set the sight scale at the ordered range and the peep sight at the ordered deflection and correct for difference of level of wheels. Elevate and traverse until line of sight through peep and front sights is on the target. When used in connection with the panoramic sight it may be used for direct or indirect firing.

CARE OF THE REAR SIGHTS.

For traveling, the sight shank is withdrawn from the shank socket, covered with the cover for the sight shank, and placed in its packing in the left trail box. A cover is provided to protect the surfaces of the shank socket and should be slipped over the sight bar when the shank is removed.

When convenient, and especially when not in use in garrison, the sight shanks and panoramic sights should be removed from the carriages and kept in some dry place, as in the barracks storeroom or office.

All parts of the sight shanks and shank sockets should be kept clean, free from rust, and lightly oiled. When stored or not used for short periods they should be thoroughly cleaned and well coated with light slushing oil. Should any part become rusted, it should be carefully cleaned by softening the rust with kerosene oil and rubbing with a soft pine stick.

In handling all parts of sights care must be exercised to avoid injuring them by dropping, striking them upon or with other parts, etc.

Extra glass level vials assembled in brass tubes, to replace broken vials in sights, except for the angle of site level, will be issued on requisition. In case the latter level requires replacement the level holder will be removed and turned in to an arsenal designated by the armament officer.

Only ordinary tools, such as a hammer and a punch or a piece of wire, are required for the removal of pins from level caps in order to replace vials. All pins on level caps are driven in toward the center of the instrument. They should be driven out in the opposite direction. Four radial screws in the vial tubes are used for adjusting the tubes in their holders.

ADJUSTMENT OF SIGHTS.

The sights are correctly adjusted when, at zero elevation and deflection, the line of sight is parallel to the axis of the bore. With the gun horizontal and the range scale at zero, the reading of the elevation disk should be 300 when the bubble is at the center of its vial.

In adjusting the sights the panoramic sight should first be corrected. If the rear sight is taken first, it will require readjustment, provided the adjustment of the panoramic sight causes a change in position of the range strip.

TO ADJUST THE REAR SIGHT.

The rear-sight shank is set at zero elevation and the direction of the line of sight is changed by means of the peep-sight screw and by altering the front sight until the line of sight is parallel to the axis of the bore. The method of determining when this condition exists is given below. The deflection scale on the sight shank is then shifted until its zero registers with the index on the peep sight. This movement of the deflection scale is provided for by elongated holes in the scale, through which pass the screws which clamp it in position on the sight shank. The front-sight holder is attached to

the sight fastening in a manner to provide means of altering its height as previously explained.

To adjust the elevation level holder: With the bore of the piece horizontal and the sight set at zero elevation, the position of the level holder is changed by the level screw until the bubble is in the center of its vial. The nut inside the level handle which clamps the graduated disk is released and the disk rotated until zero comes opposite its index.

TO ADJUST THE PANORAMIC SIGHT, MODEL OF 1915.

Should backlash or lost motion appear lengthwise in the elevation device, it can be removed by loosening the elevation-worm retaining-nut screw, setting up on the elevation-worm retaining nut, and then tightening up on the elevation-worm retaining-nut screw. To remove backlash between the threads of the elevation worm and worm teeth of the elevation segment, loosen the bushing clamp plug screw which releases the elevation-worm bushing clamp plug, and then turning the elevation bushing, in which the elevation worm is eccentrically mounted, so as to bring the elevation worm closer in contact with the worm teeth of the elevation segment. The elevation-worm adjusting clamp plug must be firmly clamped after adjusting by tightening up on the bushing clamp plug screw to secure the elevation-worm bushing against rotation. After adjusting, should the zero, upon the elevation worm micrometer head not coincide with its index when the elevation index coincides with the graduations of the scale upon the rear face of the rotating head, it can easily be remedied by the loosening up on the locking screw and turning the elevation-worm micrometer head until the zero just coincides with its index, after which it must be firmly secured by tightening up on the locking screw.

Backlash which may occur between the threads of the azimuth worm and the worm teeth of the azimuth worm wheel is taken up automatically by the spring that forces the throw-out plunger which seats the azimuth worm at its left end in toward the azimuth worm wheel. The four elongated holes in the azimuth scale afford means for adjusting when its zero does not coincide with the arrow head upon the upper exterior diameter of the azimuth worm-wheel cover when the zero of the deflection scale, upon the rear of the azimuth worm-wheel cover, coincides with arrow head upon the deflection index. After this adjustment is made the azimuth micrometer knob should be inspected similar to that of the elevation-worm micrometer head.

Backlash, that appears between the threads of the deflection worm and the worm teeth of the deflection worm wheel and support ring, can readily be removed when the method of adjusting similar to that of the elevation device is followed out.

TO ADJUST THE PANORAMIC SIGHT, MODEL OF 1904.

Direct the panoramic sight by means of the azimuth micrometer knob and rear sight scroll gear until its line of sight is parallel to the axis of the bore. The method of determining when this condition of parallelism exists is described hereafter. Without disturbing the direction of this line of sight move the azimuth micrometer knob of panoramic sight and the range strip of the rear sight until the zero marks come opposite their respective indices. The azimuth micrometer knob may be moved after loosening the locking screw in the end of the worm. This locking screw may be loosened by the combined teat wrench and screw driver issued for the purpose. If the azimuth micrometer knob can not be readily removed, grasp the sight by the azimuth micrometer knob, release the worm from the worm gear of the azimuth circle, and gently tap the exposed end of the worm with a small piece of wood or soft metal.

To locate the index opposite the zero of the scale, loosen the four screws that hold the movable index cover in place and move this cover until the index is properly located, then tighten the screws. Movement of the range strip of the rear sight is made possible by a slot in the shank in which the range-strip screw can be moved when the nut has been loosened.

CARE OF THE PANORAMIC SIGHT, MODELS OF 1904 AND 1915.

These sights are delicate instruments and must not be subjected to any rough usage, jars, or strains. In firing they remain in position on the carriage; in the field, when not in use, they are kept in the padded leather cases prepared for them on the rear of the main shield.

To obtain satisfactory vision, the glasses must be perfectly clean and dry. The T lug on the sight and the slot forming its seat should be kept lightly oiled as a preventive of rust. The worm and worm rack should be oiled with vaseline. When dust accumulates on the pointers it should be removed by a fine camel's-hair brush in the hands of an experienced person.

To clean the rotating-head window and the front face of the rotating head, do not remove the rotating-head window from the window cell.

To clean the reticule and eyepiece lenses, remove the screw holding the eyepiece to the eyepiece elbow and unscrew the eyepiece. To disassemble the lenses remove the set screw on the underside of the eyepiece and unscrew the eye-lens cell. The field lens is held in place by a retaining spring, both of which may drop out as soon as the eye-lens cell is disassembled.

In assembling note that the flat surface of the field lens of the eyepiece is placed next to the reticule. Do not remove or change the adjustment of the reticule. Its rear surface may be cleaned with a camel's-hair brush after the eyepiece has been removed.

In panoramic sights of serial numbers after 752 the exposed optical elements and all nonmoving joints are sealed and no attempt should be made to remove them.

For serial numbers 873 and up the slight change in the appearance and construction of the elbow and rotating head is made for the purpose of making these parts dust and moisture proof.

VERIFICATION OF PARALLELISM OF LINES OF SIGHT AND AXIS OF BORE.

By construction the vertical plane of the lines of sight at zero deflection is distant 17.5 inches from the vertical plane of the axis of the bore; the horizontal plane of the line of sight of the rear sight at zero elevation is distant 8 inches from the horizontal plane of the axis of the bore; the corresponding distance for the line of sight of the panoramic sight is 14.657 inches. Therefore, when the carriage is placed with wheels on a level platform, the gun with axis of bore horizontal, and the sights at zero elevation and deflection, the points in which the lines of sight and the axis of the bore prolonged pierce a distant plane perpendicular to the latter should be located with reference to each other as indicated above, provided the sights are correctly adjusted.

The details of a method for the practical verification of this adjustment are as follows:

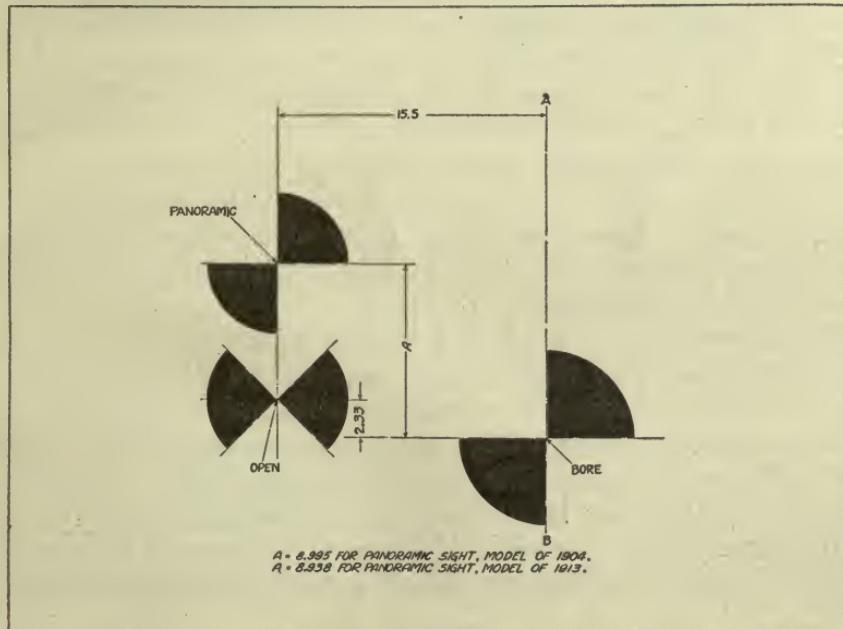


FIGURE 1.

A target of dimensions given in figure 1 is placed in a vertical position perpendicular to the line of sight at a distance of not less than 100 yards from the gun (and at such a height that the point "bore" is at the same height as the axis of the bore of the gun). The

verticality of the target is assured by a plumb line attached at A, coinciding with the vertical line A B.

The carriage is placed with the wheels and trail resting upon solid supports of wood or stone, the surfaces of which have been carefully leveled so as to bring the axle axis horizontal. Now, direct the gun so that the prolongation of the axis of the bore, as determined by the bore sights, pierces the target at the proper point; the lines of sight of the open and panoramic sights are then adjusted in direction by the means explained above until they pierce the targets in the points marked, respectively, "open" and "panoramic."

The axis of the bore is determined and prolonged by means of bore sights. In the absence of such means a breech-bore sight may be made from an empty cartridge case from which the primer has been removed; a piece of paper should be pasted over the primer seat and a pinhole made in its exact center to serve as a peep sight. If the cartridge case does not completely fill the bore, it should be shimmed all around with tissue paper until it does so. For a muzzle-bore sight use should be made of the traces of the horizontal and vertical planes containing the axis of the bore, which are marked on the muzzle of the gun. Fine threads or hairs stretched across the muzzle to coincide with these lines form a good bore sight, and the ends of such threads may be conveniently fastened to a cloth strap buckled around the muzzle of the gun.

In the field, where from lack of time or proper facilities the method just given can not be followed, the adjustment of the sights may be verified by bringing the lines of sight at zero elevation and deflection to bear upon some sharply defined point of a distant object. At such a range (for instance, 2,000 yards or more) the parallax may be neglected, and if the sights are correctly adjusted the lines of sight and the prolongation of the axis of the bore will sensibly pass through the selected aiming point.

The adjustment of the sights is of such importance and should be verified so frequently that battery commanders will find it advantageous to make permanent arrangements for such verification. The leveled supports constituting the carriage emplacement should preferably be of stone. The site of the target (fig. 1) should be prepared, and the exact locations of the target and horizontal reference points permanently marked. If these arrangements are properly made, subsequent verifications of sights will become a simple matter.

ADDITIONAL TESTS.

After the sights are adjusted they should be subjected to the following tests to insure their accuracy at extremes of elevation and azimuth:

(a) With carriage level and gun and sights at zero elevation and deflection the lines of sight and axis of bore prolonged pierce the target (fig. 1) in the proper points.

(b) The gun is then moved to its maximum elevation; as the sight elevation is altered the lines of sight should follow the vertical lines through the same points of the target (fig. 1).

(c) With conditions as in (a) the gun is moved upon the carriage to its extreme positions in azimuth; as the sight deflections are now altered the lines of sight should follow the horizontal lines through the same points on the target (fig. 1).

By construction and assemblage the sights, if correctly adjusted, should fulfill the above conditions with substantial accuracy. If error be noted, a report of the facts of the case with the cause, if known, should be made to the ordnance officer charged with the repair of the matériel for his information and action.

SPARE SIGHTS.

To each battery is issued one set of spare sights, consisting of one front-sight holder with sleeve, complete, one sight bar with lever, link, link bolt, and sight shank, complete, and one panoramic sight. These parts are carried in a special packing chest in the battery wagon.

One set of bore sights (consisting of one breech and one muzzle bore sight) and one testing level for use in adjusting sights, etc., are also issued to each battery.

ADJUSTING INSTRUMENTS.

A complete detailed description of the method of disassembling and adjusting the different instruments is given in Ordnance Office Pamphlet No. 1795, Instructions for the Care, Preservation, Repair, and Adjustment of Instruments for the Fire-Control Systems for Coast and Field Artillery. Attention is invited to General Orders No. 47, War Department, March 24, 1905, with reference to the care and repair of panoramic sights, battery commander's telescopes, and range finders.

No disassembling of instruments except as prescribed herein will be permitted. The disassembling of telescopic instruments allowed herein must be done only in the presence of a commissioned officer. Disassembling as permitted in pamphlet 1795 must be done only by officers or employees of the Ordnance Department.

TARGETS.

The description and allowances of targets and accessories for mobile Artillery are given in Ordnance Office pamphlet, Form No. 1994: "Mobile Artillery Targets and Accessories."

GENERAL INFORMATION.

PAINTING ARTILLERY MATÉRIEL.

(Class X, Section 10.)

The paint issued for this purpose is of olive-drab color, put up in 5-pound cans ready for use, and is applied to both wood and metal parts. If the paint is too thick, turpentine should be used as a thinner, but not to greater extent than 2 per cent by volume.

All steel and iron nonbearing surfaces will be painted, including that portion of the underside of the gun between the clips. Wearing and bearing surfaces, teeth of gear wheels, elevating screws, piston rods, cylinders, counter-recoil springs, and interiors of spring cylinders will not be painted.

All parts to be painted should be free from dirt or grease. They may be washed in a liquid made by dissolving one-half pound sal soda in 8 quarts of warm water, then rinsed in clean water, and wiped thoroughly dry.

Where the matériel is in fair condition and only marred in spots, the marred places should be primed with olive-drab paint, second coat, and permitted to dry. Then the whole surface should be sandpapered with No. 1½ sandpaper and a coat of paint applied and allowed to dry thoroughly before use.

Where the matériel is in bad condition all parts should be thoroughly sandpapered with No. 2½ sandpaper, be given a coat of paint, and be permitted to dry for at least 24 hours; then sandpaper with No. 00 sandpaper, apply a finishing coat, and permit the parts to dry thoroughly before use.

In general, two coats of paint per year will be sufficient to keep the matériel in good condition. After repeated painting the paint may become so thick as to scale off in places or give an unsightly appearance. It may then be removed for repainting, as follows:

Dissolve 1 pound of concentrated lye, powdered form, in 6 pints of hot water, and slake in enough lime to give the solution the consistency of paint. Use the solution freshly mixed and apply to the parts where paint is to be removed with a brush or with waste tied to the end of a stick. When the solution begins to dry on the surface use a scraper to remove the old paint, and complete the cleaning of the surface with cloth and water. If one application is not sufficient to loosen the paint, apply a second coat. Before painting wash the surface with sal-soda water, rinse with clean water, and then wipe thoroughly, as described above.

OILS FOR ARTILLERY MATÉRIEL.

For the service, cleaning, and preservation of this matériel the Ordnance Department issues hydroline oil, lubricating oil (or engine oil No. 1), clock oil, sperm oil, coal oil, neat's-foot oil, and light slush-

ing oil. Each of these oils is suited for the particular purpose for which it is issued, as stated below, and care should be taken that it is not used for other purposes.

The hydroline oil is for use in the recoil cylinders of the carriages and *for no other purpose*.

The lubricating oil (or engine oil No. 1) will be used exclusively in all oil holes of the matériel, and in lubricating such parts as wheels and axles, gun and cradle slides, pintle bearing, elevating and traversing mechanisms, exterior of cylinders, brake bearings, hinges, different surfaces of breechblocks, threads of breech recess, etc.

Clock oil should be used on the spindle and all bearings of the battery commander's telescope, bearings of the panoramic sight, and fuse setters, and on the observation telescope, field artillery plotter, sextant telemeter, and worms of the rear sight. In all cases clock oil should only be used when the instruments mentioned are disassembled for cleaning. When used it should be applied by dropping from the end of the dropper attached to the end of the cork.

The sperm oil is a lighter lubricant than the engine oil No. 1, and may be used on the gears of sights, fuse setters, parts of revolvers, etc.; engine oil No. 1 may also be used on such parts.

Coal oil is used by the Ordnance Department for cleaning purposes. In the field it may be used for lanterns. Coal oil for general illuminating purposes is furnished by the Quartermaster's Department.

Neat's-foot oil is used for the care and preservation of all leather equipment, and should be applied as directed on pages 95 to 97.

Light slushing oil is prescribed for use in the protection and preservation of all bright or unpainted surfaces of steel or iron on all parts of the equipment when the matériel is to remain unused for an appreciable length of time. Its use as a lubricant for mobile artillery is forbidden.

Before applying the slushing oil to any surface, the part should be thoroughly cleaned, so as to be free from rust, water, coal oil, lubricating oil, etc., as their presence will cause rusting under the slushing oil. The slushing oil should then be applied in a *thin, uniform coat*, since this is ALL that is necessary to give good protection.

All unpainted surfaces should be kept clean and free from rust, but in no case is a polish required.

Except in very cold weather it can be applied by using a paint brush as when painting; in cold weather it should be applied by stippling—that is, lightly tapping the surface with the end of the sash tool, held with bristles perpendicular to the surface to be covered. It can be applied to the bores of gun by the slush brush issued for the purpose. In cold weather it should be warmed before use for coating the bores of gun.

It may be readily removed by the use of burlap or waste dipped in coal oil.

REPAIRS FOR FIELD ARTILLERY MATÉRIEL ISSUED TO THE UNITED STATES ARMY AND THE NATIONAL GUARD.

Instructions relative to making repairs to field batteries and furnishing ordnance stores and supplies for them will be found in General Orders, No. 9, War Department, Washington, January 12, 1911; General Orders, No. 116, of 1911; and General Orders, No. 136, of 1911, so far as pertains to the United States Army, and in General Orders, No. 225, War Department, Washington, December 19, 1910, so far as pertains to the Organized Militia.

Instructions in reference to the care, use, and repair of delicate instruments, such as sights, telescopes, and range finders, will be found in General Orders, No. 47, War Department, Washington, March 24, 1905.

SUGGESTIONS FOR CARE AND MAINTENANCE OF MATÉRIEL.

Various suggestions in reference to the care of this matériel and hints regarding things to be done or to be avoided are scattered throughout the text of this handbook; some of the more important are here condensed for more convenient reference. Careful compliance with these suggestions will avoid delay and possible injury to personnel or matériel.

The breechblock should not be opened for at least one minute after a misfire.

All work upon recoil cylinders, sights, and other optical equipment should be done in the presence of a commissioned officer.

The recoil cylinder should never be clamped in a vice, but when necessary to hold it from turning, a spanner applied to front end of cylinder should be used.

Never remove the cylinder-retaining ring when the piece is at an elevation.

See that proper kind of oil is used in cylinders and for lubrication.

Strain the oil used in filling the cylinders through a fine, clean cloth, and be sure that the receptacles used in handling the oil are clean.

Take every precaution to keep the interior of the cylinders clean and to prevent the entrance of foreign particles.

In assembling the gland, be sure that at least eight threads of the gland are engaged with the threads of the stuffing box.

Lash parts with copper wire to prevent unscrewing.

Before firing, inspect to insure that cylinders are properly closed and that the cylinder retaining ring and the piston-rod nut are in place.

If time permits, oil slides before firing.

If the gun fails to return fully into battery, except when caused by expansion of oil, it is probably due (1) to dirt on sides and guides; (2) to cutting of sliding surfaces on account of dirt and lack of oil; (3) to gland being screwed up too tightly; (4) to dirt or foreign particle in the cylinder, and especially in the counterrecoil buffer recess; (5) to weakness of springs. Ninety per cent of such cases will be found due to (1), (2), or (3).

At all times, except when used for firing, the rocker should be disengaged from the howitzer.

To relieve the elevating mechanism, the howitzer should be locked by means of the rear traveling lock when traveling. The front traveling lock is intended to be used only in case of emergency when there is not time to retract the howitzer to the position afforded by the rear traveling lock. The object of the rear traveling lock is to permit the howitzer to be retracted from its firing position, thereby relieving the carriage axle and wheels of some of the weight and transmitting it to the carriage limber.

The length of the recoil of the howitzer during firing should be carefully observed. The approximate recoil that should be obtained for different elevations is as follows:

	Inches.
5 degrees depression.....	63
0 degrees 30' depression.....	63
4 degrees elevation.....	61
8 degrees 30' elevation.....	57
13 degrees elevation.....	54
17 degrees 30' elevation.....	50
22 degrees elevation.....	43
26 degrees 30' elevation.....	37
31 degrees elevation.....	30
35 degrees 30' elevation.....	26
40 degrees elevation.....	26

If the variation from these recoils differs by more than 5 per cent over or 10 per cent short, it should be investigated and the cause for this variation ascertained and remedied.

For satisfactory action of the recoil-controlling parts it is necessary that the cylinder be filled with oil in the exact method previously given and that the parts be kept scrupulously clean. For that purpose the ports in the liner and valve should be carefully inspected before assembling to see that no foreign particles have collected in them.

One set of covers will be issued, as noted under the description of the carriage. The elevating-worm mechanism must at all times be kept thoroughly clean, as dust and dirt will interfere with its operation and often prevent its being used at all. The traveling covers do not protect this part of the carriage, and particular attention is invited to the fact that the elevating-worm mechanism must be thoroughly cleaned before using.

Keep hub bolts and hub bands properly tightened.

To tighten hub bands, screw them as tightly as possible with the wrench and then force them further by striking the end of the wrench with a hammer.

Do not permit brake levers to be released by a kick or a blow.

Remove locking screw before trying to unscrew cylinder-retaining ring.

Prevent possible injury to cannoneers by causing them to stand clear of the counter-recoil spring column in assembling or dismounting.

In moving the gun on or off the cradle, provide ample support for the breech end, so that the gun clips are in prolongation of the cradle guides; if this is not done, the cradle guides may be ruined.

Do not strike any metal part directly with a hammer; interpose a buffer of wood or copper.

Frequently verify the adjustment of sights.

Require special care in handling sights.

Be sure that the range strip of the rear-sight shank is graduated for the particular type of ammunition as used by the battery.

Do not unnecessarily expose ammunition to the sun or load it into a warm gun before time for firing; if this is done, erratic shooting may result.

Battery commanders should frequently make a detailed inspection of all the vehicles in the battery to see if any parts of them are broken and any nuts, screws, split pins, etc., missing. If any such defects are found, he should immediately take steps to replace broken or missing parts. This is of the utmost importance, and compliance with these instructions will do much toward prolonging the life of the vehicles.

It has been found that the apron hinges occasionally become broken, and that the apron-hinge pins are frequently lost. Whenever this happens the hinges or hinge pins should be immediately replaced, for if this is not done the apron, which is a very expensive piece, is apt to become cracked or broken.

Whenever the lunettes become loosened the lunette nuts should at once be tightened up.

All wheels and pintle bearings should be frequently oiled.

When orders for spokes for repairing wheels are given, they should specify which kind of spokes are required (right or left), there being two kinds, due to the relative locations of the hub bolts.

All nuts are secured by split pins, which should be replaced and properly opened when nuts are screwed home.

All working and bearing surfaces of the carriage require oiling; those not directly accessible for this purpose are provided with oil holes closed by spring covers or handy oilers.

See that fuzes are set at safety for transport.

Use the small primer-inserting press for inserting primers in cartridge cases and the decapping tools provided for removing old primers.

In all requisitions and correspondence the correct name of the part referred to (if known) should be given. If the name of the part is not known, submit a sketch showing the location, shape, matériel, etc., sufficient to establish definitely the identity of the parts in question.

The use of the word "complete" in requisitions to signify a combination of parts sometimes leads to misunderstanding of the exact parts wanted. The tables of nomenclature of parts have been arranged to show the parts included under the terms "one trail, complete; one wheel, complete," etc., and should be carefully studied before requisitions are made out, to insure that all the parts wanted are included and duplications avoided. For example, if a piston rod is wanted the order should state whether it is to be with or without the nut. If all details are itemized, it will avoid mistakes and unnecessary expense.

SUPPLIES IN GENERAL.

All bits, both curb and snaffle, are made of 30 per cent nickel steel, a practically noncorrosive metal.

The olive-drab saddle blanket is regulation for all arms of the service.

The supply of ammunition to be kept on hand in a 6-inch howitzer battery will be a sufficient amount to fill all the ammunition chests of the equipment, and in addition a sufficient number of rounds to cover the needs for annual target practice.

Revolver arm racks are issued for use of Field Artillery in such number as may be required to hold the revolvers on hand in the battery. Each revolver arm rack holds 80 revolvers.

Lanyards with metal snaps are issued with revolvers when called for.

Such articles as may be needed for training the horse—the cavesson, longing rein, running rein, etc.—may be readily made up by the battery saddler from supplies furnished by the Ordnance Department.

For the training of enlisted men leather heads and wooden stands for supporting them will be needed. The saddler and the wheelwright or carpenter will be able to supply these by means of the tools in the forge limber and battery wagon.

Odometer and reconnaissance instruments are furnished by the Engineer Department.

A reloading and cleaning outfit for 6-inch howitzers for removing fired primers from and cleaning cartridge cases and for reloading blank ammunition is furnished to each battery.

METHOD OF LOADING ONE 6-INCH HOWITZER BATTERY FOR TRANSPORTATION BY RAIL.

The flat cars usually obtained from railroad companies vary in length from 34 to 44 feet. Cars longer than 42 feet are unusual, and cars longer than 44 feet are very seldom seen at all.

In loading a battery on cars during service operations it is very desirable to keep complete gun sections together as much as possible. Pursuing this idea, a 6-inch howitzer battery on war footing may be loaded as follows when cars at least 38 feet long are obtained:

Four cars, each to contain—

- One 6-inch howitzer and carriage.
- One 4.7-inch gun and 6-inch howitzer limber.
- Two 6-inch howitzer limbers.
- Two 6-inch howitzer caissons.

One car to contain—

- One 6-inch howitzer battery wagon.
- One 4.7-inch gun and 6-inch howitzer forge limber.
- Two 6-inch howitzer limbers.
- Two 6-inch howitzer caissons.

One car to contain—

- One 6-inch howitzer store wagon.
- One 4.7-inch gun and 6-inch howitzer store limber.
- Two 6-inch howitzer limbers.
- Two 6-inch howitzer caissons.

If a 6-inch howitzer battery, having 8 limbers and 8 caissons, is to be transported, it may be loaded as follows when cars at least 38 feet long and less than 44 feet long are obtained:

Four cars, each to contain—

- One 6-inch howitzer and carriage.
- One 4.7-inch gun and 6-inch howitzer limber.
- Two 6-inch howitzer limbers.
- Two 6-inch howitzer caissons.

One car to contain—

- One 6-inch howitzer battery wagon.
- One 6-inch howitzer store wagon.
- One 4.7-inch gun and 6-inch howitzer forge limber.
- One 4.7-inch gun and 6-inch howitzer store limber.

This car will be only about three-quarters filled if a 38-foot car is procured. The additional space may be utilized as the battery commander sees fit.

If cars less than 38 feet long are obtained, one limber or one caisson will have to be omitted. If cars 44 feet long are obtained, one additional limber or caisson can be loaded on the same.

In loading the cars, if there is any permanent loading platform along the railroad tracks in the vicinity, the vehicles should be run on

to these platforms and loaded from them. If there is no permanent platform in the vicinity, it will be necessary to build a temporary ramp. This should be built at the end of the cars. When loading vehicles from a permanent platform on the side of the cars it may be necessary, if short cars are obtained, to remove the pole of the last limber placed on the car in order to get the same on to the car. The pole should, however, be replaced in its socket as soon as the vehicle is placed in position.

When loading the cars care must be exercised to load them so that there can be no movement of the vehicles on the cars longitudinally, transversely, or vertically. All wheels and trails of carriages, poles of limbers, lunettes of caissons and wagons must be secured to the bottom of the car. The vehicles are secured as follows: 3 by 4 inch timbers nailed to the floor of the cars on both sides of all the wheels hold the wheels securely against transverse motion; 3 by 4 inch chocks nailed to the 3 by 4 inch pieces which lie along the sides of the wheels hold the wheels against longitudinal motion on the cars; 3 by 4 inch timbers, placed over the felloes, resting on the floor, between the two lowest spokes and bolted to the floor of the car with two $\frac{1}{2}$ -inch bolts, hold the wheels against vertical motion. The bolts should preferably be bolted through these braces on the outside of the wheels.

If bolts for bolting these 3 by 4 inch crosspieces can not be obtained, the crosspieces should be nailed down with 7 or 8 inch spikes. The poles and lunettes should be secured to the floor by nailing one 3 by 4 inch block on both sides of same, and one 3 by 4 inch piece across the top near the end of the poles or lunettes.

The trails should be secured to the floor by nailing 3 by 4 inch blocks as follows:

One on each side of the trail.

One at the end of the trail in prolongation of the axis.

One across the top near the end.

All of the lumber used on the cars is 3 by 4 inch stock. To load a 6-inch howitzer battery on war footing will require 1,100 linear feet of 3 by 4 inch lumber; a battery with 8 limbers and 8 caissons will require 920 linear feet.

For carrying all harness and all accessories of the vehicles which are not carried in compartments of these vehicles or rigidly attached to them, one box car should be obtained. The material in this box car should be packed in boxes if on hand. In case no box car can be obtained all of the harness, etc., should be packed in boxes and placed on the flat cars near the vehicles. These boxes must be securely fastened to the floor to prevent them from falling off of the cars or from striking and injuring the vehicles.

EQUIPMENT.

The following table sets forth the total equipment of one 6-inch howitzer battery on war and peace footing. The right-hand column shows in general where each article should be carried, but the battery commander may use his discretion as to the disposition of many articles for which no particular fitting or receptacle is provided.

Statement of total equipment of one 6-inch howitzer battery.

War footing (4 guns and 12 cais- sons).	Article.	Location, etc.	Property classification.	
			Class.	Sec- tion.
WHEELED MATERIEL.				
4	Howitzers and howitzer carriage.			
4	Howitzer limbers.			
12	Caissons.			
12	Caisson limbers.			
1	2-horse reel.			
1	Battery wagon.			
1	Forage limber.			
1	Store limber.			
1	Store wagon.			
2	Kit or escort wagons (furnished by Quartermaster's Department).			
TOOLS AND ACCESSORIES FOR HOWITZER AND HOWITZER CARRIAGES, MODEL OF 1908 AND 1908 M1.				
4	Breech cover.	On howitzer.		
4	Canvas tool kits, each containing—	In right trail box (in pocket)—		
	1 cross peen hammer.	No. 2.		
	1 0.375 and 0.5 wrench.	No. 3.		
	1 screw driver, 3-inch blade.	No. 4.		
	1 sight wrench.	No. 6.		
	1 small bronze drift.	No. 7.		
	1 small punch.	No. 8.		
	1 pliers, wire-cutting, 8-inch.	No. 9.		
	1 screw slot wrench and blade.	No. 10.		
	1 screw wrench, 8-inch.	No. 11.		
	1 0.75-inch cold chisel, 8 inches long.	No. 12.		
	1 large bronze drift.	No. 13.		
	1 6-inch 3-square dead smooth file.	No. 14.		
	1 8-inch hand smooth file.	No. 15.		
	1 0.625 and 0.75 wrench.	No. 16.		
4	Cleaning brushes.	In right trail box.		
4	Double spanners.	do.		
4	Double wrenches.	do.		
8	Dust guards.	On wheels.		
8	Hand fuze setters, with cases.	In right trail box.		
4	Horizontal oilers.	do.		
8	Lanyards.	do.		
4	Leather pouches for spare parts.	On supports on trail.		
8	Loading hand barrows.	On left side of trail.		
4	Maneuvering bars.	On howitzer.		
4	Muzzle covers.	In right trail box.		
4	Oil-can boxes.	In left trail box.		
4	14-inch panoramic sight extensions.	In right trail box.		
4	Maneuvering chains.	In right trail box.		
4	Retracting eyes.	do.		
4	Screw wrenches, 15-inch.	do.		
4	Sight bar covers.	On sight bars.		
4	Sight shank covers.	On sight shanks.		
4	Socket wrenches.	In right trail box.		
4	Spanners (for 60-inch wheel).	do.		
4	Spanner wrenches.	do.		
4	Sponges and rammers.	On right side of trail.		
4	Sponge covers.	On sponges.		
4	Traveling breech covers.	On howitzer.		
4	Traveling muzzle covers.	On howitzer.		
4	Traveling thrust bearing wrench.	In right trail box.		
4	Valve retainer tools.	do.		
4	Wire, 3-pound spools, No. 20, annealed bare copper.	do.		
4	Wrenches, 1 by 1.25.	do.		

Statement of total equipment of one 6-inch howitzer battery—Continued.

War footing (4 guns and 12 cais- sons).	Article.	Location, etc.	Property classification.			
			Class.	Sec- tion.		
SPARE PARTS FOR HOWITZERS AND HOWITZER CARRIAGES.						
(For howitzers.)						
1	Breech mechanism, complete, including block carrier, loading tray and extractor, and small parts.	In spare breech mechanism chest in battery wagon.				
4	Block latches.....	In leather pouches for spare parts	IV	3		
4	Block-latch springs.....	.....do.....			
4	Firing pins.....	.....do.....			
4	Firing-pin springs.....	.....do.....			
4	Firing-spring sleeves.....	.....do.....			
2	Handy oilers.....	.....do.....			
4	Hinge-pin keys.....	.....do.....			
4	Lever latch pivots.....	.....do.....			
4	Lever latch springs.....	.....do.....			
8	Lever pivot detents.....	.....do.....			
4	Locking bolts, nuts, and pins.....	.....do.....			
4	Locking-bolt springs.....	.....do.....			
4	Sears.....	.....do.....			
4	Tray latches.....	.....do.....			
4	Tray-latch springs.....	.....do.....			
8	Trigger-shaft detents.....	.....do.....			
<i>For fuze setters.</i>						
4	Corrector scale screws.....	In leather pouches for spare parts	IV	3		
16	Range ring screws.....	.....do.....			
<i>For carriages.</i>						
(Parts common to 6-inch howitzer carriages, models of 1908 and 1908 MI.)						
1	Apron latch, complete, consisting of— 1 body.....	In store wagon, compartment "C"; 2 extra springs in chest for miscellaneous spare parts.				
	1 handle.....	.....do.....			
	1 handle pin.....	.....do.....			
	1 plunger.....	.....do.....			
	3 springs (1 assembled, 2 extra).....	.....do.....			
1	Apron latch washer.....	In chest for miscellaneous spare parts				
2	Bell-crank bearing bolts, with nuts.....	.....do.....			
1	Bell-crank bolt with nut.....	.....do.....			
1	Brake eccentric strap.....	.....do.....			
1	Brake lever with catch and hook.....	In store wagon, compartment "K".				
2	Brake lever catches.....	In chest for miscellaneous spare parts				
4	Brake-lever hooks.....	.....do.....			
2	Brake-lever pins.....	.....do.....			
2	Brake-rod pins.....	.....do.....			
2	Brake-rod pins (type A).....	.....do.....			
1	Brake-segment rack.....	.....do.....			
4	Brake shoes.....	In store wagon, compartment H-K.				
2	Brake-shoe pins.....	In chest for miscellaneous spare parts				
2	Brake springs with rivets.....	.....do.....			
4	Counterrecoil springs, inner.....	In compartments G and H, battery wagon, and compartment G, store wagon.				
4	Counterrecoil springs, outer.....	.....do.....			
6	Cradle clip pins (type A).....	In chest for miscellaneous spare parts				
6	Cradle-head swing bolts with nuts.....	.....do.....			
1	Cylinder-gland lock with split pin.....	.....do.....			
1	Cylinder-gland lock fulcrum.....	.....do.....			
4	Elevating-gear case bolts with nuts.....	.....do.....			
1	Elevating-gear hand-wheel shaft collar.....	.....do.....			
1	Elevating-gear right bearing bushing.....	.....do.....			
8	Elevating-worm bearing bolts with nuts.....	.....do.....			
2	Filling plugs with gaskets.....	.....do.....			
1	Firing mechanism, complete, consisting of— 1 adjusting screw.....	.....do.....			
2	2 bracket studs with nuts.....	.....do.....			
1	1 check nut.....	.....do.....			
1	1 firing handle.....	.....do.....			
1	1 firing-handle bracket.....	.....do.....			
1	1 firing-handle hub.....	.....do.....			

Statement of total equipment of one 6-inch howitzer battery—Continued.

War footing (4 guns and 12 cais- sons).	Article.	Location, etc.	Property classification.			
			Class.	Sec- tion.		
SPARE PARTS FOR HOWITZERS AND HOWITZER CARRIAGES—continued.						
<i>For carriages—Continued.</i>						
16	Firing mechanism, complete, consisting of—Continued.					
2	2 firing-handle pins (type A) (1 assembled, 1 spare).	In chest for miscellaneous spare parts				
2	2 firing links.....	do.....				
2	2 firing-link pins.....	do.....				
1	1 firing pallet.....	do.....				
1	1 firing-pallet collar.....	do.....				
1	1 firing shaft.....	do.....				
4	4 handle return springs (2 assembled, 2 extra).	do.....				
1	1 pallet-collar pin.....	do.....				
1	1 shaft trip collar.....	do.....				
1	1 trip latch.....	do.....				
1	1 trip-collar pin.....	do.....				
1	1 trip-latch pin.....	do.....				
1	1 trip-latch plunger.....	do.....				
2	2 trip-latch springs (1 assembled, 1 extra).	do.....				
16	Garlock waterproof packing, 0.375 rings.....	4 in each leather pouch for spare parts.				
4	Handspikes, complete, each consisting of—					
	1 fulcrum pin (type "A").....	In store wagon, compartment "H".....				
	2 handspike bodies.....	do.....				
	1 handspike latch.....	do.....				
	1 handspike web (with chain eye on left).	do.....				
	1 latch pin (type "A").....	do.....				
	1 lower band.....	do.....				
	1 middle band.....	do.....				
	1 tip.....	do.....				
1	Set hexagon nuts, standard, consisting of—					
	2 0.19 inch by 30 threads.....	In chest for miscellaneous spare parts.				
	2 0.25 inch by 20 threads.....	do.....				
2	Hub liners.....	In store wagon, compartment "A".....				
1	Lock washer.....	In chest for miscellaneous spare parts.				
2	Right bearing bushing bolts with nuts.....	do.....				
50	Rivets assorted.....	do.....				
	Rivets, steel, button—					
2	2 0.187 ($\frac{1}{16}$) by 0.687 ($\frac{11}{16}$).	do.....				
2	2 0.25 by 2.875.....	do.....				
10	10 0.375 by 1.25.....	do.....				
10	10 0.375 by 2.125.....	do.....				
2	2 0.5 by 1.25.....	do.....				
10	10 0.5 by 1.75.....	do.....				
6	6 0.5 by 2.562 (2 $\frac{1}{16}$).	do.....				
	Rivets, steel, countersunk, 60°—					
6	6 0.375 by 0.75.....	do.....				
2	2 0.375 by 2.125.....	do.....				
1	Safety firing device, consisting of—					
	1 safety latch.....	do.....				
	1 safety latch bearing with split pin and rivets.	do.....				
	1 safety latch plunger with split pin.....	do.....				
	1 safety latch springs (1 assembled, 1 extra).	do.....				
	1 washer.....	do.....				
2	Segment racks.....	In store wagon, compartment "K".....				
1	Sight, complete.....	In chest for spare sights.....				
1	Sight, panoramic.....	do.....				
1	Sight wrench.....	In chest for miscellaneous spare parts.				
1	Spade edge.....	In store wagon, compartment "K".....				
2	2 Spade points.....	do.....				
18	Spade point rivets.....	In chest for miscellaneous spare parts.				
1	Sponge and rammer, complete, consisting of—					
	1 carpet (with lacing).....	In store wagon, compartment "H".....				
	1 end staff.....	do.....				
	1 head staff.....	do.....				
	2 hoops (with screws).....	do.....				
	1 rammer head.....	do.....				
	1 sleeve.....	do.....				
	1 sponge head (with leather washers).....	do.....				
	1 staff coupling, female.....	do.....				
	2 staff coupling, male.....	do.....				

Statement of total equipment of one 6-inch howitzer battery—Continued.

War footing (4 guns and 12 cais- sons).	Article.	Location, etc.	Property classification.			
			Class.	Sec- tion.		
SPARE PARTS FOR HOWITZERS AND HOWITZER CARRIAGES—continued.						
<i>For carriages—Continued.</i>						
1	Sponge cover.....	On spare sponge.....				
1	Thrust bearing nut.....	In chest for miscellaneous spare parts.....				
2	Thrust bearing nut locking screw.....	do.....				
2	Top shield brace pins with chains.....	do.....				
2	Top shield fastening pins (type "A").....	do.....				
1	Traversing ball thrust bearing.....	do.....				
2	Traversing bearing caps.....	do.....				
4	Traversing bearing studs with nuts.....	do.....				
1	Traversing nut.....	do.....				
1	Traversing pivot with nut.....	do.....				
1	Traversing pivot washer.....	do.....				
2	Trunnion cap pins with split pins.....	do.....				
2	Trunnion cap swing bolts with nuts.....	do.....				
2	Valve link trunnions with nuts.....	do.....				
2	Wheels, complete.....	On battery wagon, the two hub caps in compartment "H," battery wagon.....				
2	Wheel fastenings, complete.....	In chest for miscellaneous spare parts.....				
<i>Additional parts supplied with model of 1908 carriage only.</i>						
1	Set crown nuts, special, consisting of—	In chest for miscellaneous spare parts.....				
	4 0.25 inch by 20 threads.....	do.....				
	6 0.375 inch by 20 threads.....	do.....				
	2 0.5 inch by 13 threads.....	do.....				
	6 0.5 inch by 13 threads.....	do.....				
	2 0.625 inch by 11 threads.....	do.....				
	6 0.75 inch by 10 threads.....	do.....				
	4 1 inch by 8 threads.....	do.....				
	4 1.25 inch by 7 threads.....	do.....				
	4 1.25 inch by 20 threads.....	do.....				
	2 1.625 inch by 12 threads.....	do.....				
1	Set crown nuts, standard, consisting of—	In chest for miscellaneous spare parts.....				
	2 0.25 inch by 20 threads.....	do.....				
	6 0.375 inch by 16 threads.....	do.....				
	98 0.5 inch by 13 threads.....	do.....				
	38 0.625 inch by 11 threads.....	do.....				
	16 0.75 inch by 10 threads.....	do.....				
	12 1 inch by 8 threads.....	do.....				
	2 1.5 inch by 6 threads.....	do.....				
8	Handy oilers, 0.312 ($\frac{5}{16}$) inch.....	do.....				
34	Handy oilers, 0.375 inch.....	do.....				
32	Handy oilers, 0.5 inch.....	do.....				
1	Set hexagon nuts, special, consisting of—	In chest for miscellaneous spare parts.....				
	4 0.19 inch by 30 threads.....	do.....				
	2 0.375 inch by 16 threads.....	do.....				
	2 leveling screw nuts.....	do.....				
1	Quick return mechanism, consisting of—	In chest for miscellaneous spare parts.....				
	2 bushings.....	do.....				
	4 clutch springs (1 assembled, 3 extra).....	do.....				
	1 inner spring washer.....	do.....				
	1 intermediate gear sleeve.....	do.....				
	1 outer spring washer.....	do.....				
	1 pawl, left.....	do.....				
	1 pawl, right, with handle riveted on.....	do.....				
	1 pawl shaft with washer and nut.....	do.....				
	4 pawl springs (2 assembled, 2 extra).....	do.....				
	1 pinion shaft with nut.....	do.....				
	1 pinion shaft clutch.....	do.....				
	2 plungers with split pins.....	do.....				
9	Spade edge rivets.....	In chest for miscellaneous spare parts.....				
1	Set split pins, consisting of—	Carried equally in the leather pouches for spare parts.....				
	4, 0.046 ($\frac{5}{64}$) by 0.312 ($\frac{5}{16}$) inch.....	do.....				
	4, 0.062 ($\frac{1}{16}$) by 0.562 ($\frac{9}{16}$) inch.....	do.....				
	12, 0.062 ($\frac{1}{16}$) by 0.75 inch.....	do.....				
	3, 0.093 ($\frac{3}{32}$) by 0.75 inch.....	do.....				
	45, 0.093 ($\frac{3}{32}$) by 1 inch.....	do.....				
	4, 0.125 by 0.75 inch.....	do.....				
	20, 0.125 by 1 inch.....	do.....				

IV 3

Statement of total equipment of one 6-inch howitzer battery—Continued.

War footing (4 guns and 12 cais- sons).	Article.	Location, etc.	Property classification.	
			Class.	Sec- tion.
SPARE PARES FOR HOWITZERS AND HOWITZER CARRIAGES—continued.				
	<i>Additional parts supplied with model of 1908 carriage only—Continued.</i>			
	Set split pins, consisting of—Continued.			
	150, 0.125 by 1.25 inch.....	Carried equally in the leather pouches for spare parts.		
	10, 0.125 by 1.5 inch.....	.....do.....		
	4, 0.156 ($\frac{5}{16}$) by 1 inch.....	.....do.....		
	8, 0.156 ($\frac{5}{16}$) by 1.25 inch.....	.....do.....		
	40, 0.156 ($\frac{5}{16}$) by 1.5 inch.....	.....do.....		
	10, 0.156 ($\frac{5}{16}$) by 1.75 inch.....	.....do.....		
	10, 0.156 ($\frac{5}{16}$) by 2.25 inch.....	.....do.....		
	4, 0.203 ($\frac{11}{32}$) by 2 inch.....	.....do.....		
	12, 0.203 ($\frac{11}{32}$) by 2.25 inch.....	.....do.....		
	2, 0.25 by 1.25 inch.....	.....do.....		
	3, 0.25 by 1.5 inch.....	.....do.....		
	4, 0.25 by 2.75 inch.....	.....do.....		
	15, 0.25 by 3 inch.....	.....do.....		
2	Spring covers No. 1, with screws and washers.	In chest for miscellaneous spare parts.		
	<i>Additional parts supplied with model of 1908 M1 carriages only.</i>			
1	Set crown nuts, special, consisting of—			
	4, 0.25-inch by 20 threads.....	In chest for miscellaneous spare parts.		
	6, 0.375-inch by 20 threads.....	.....do.....		
	2, 0.5-inch by 13 threads.....	.....do.....		
	8, 0.75-inch by 10 threads.....	.....do.....		
	6, 0.75-inch by 10 threads.....	.....do.....		
	4, 1-inch by 8 threads.....	.....do.....		
	4, 1.25-inch by 7 threads.....	.....do.....		
	2, 1.625-inch by 12 threads.....	.....do.....		
1	Set crown nuts, standard, consisting of—			
	2, 0.25-inch by 20 threads.....	.....do.....		
	20, 0.375-inch by 16 threads.....	.....do.....		
	74, 0.5-inch by 13 threads.....	.....do.....		
	46, 0.625-inch by 11 threads.....	.....do.....		
	20, 0.75-inch by 10 threads.....	.....do.....		
	8, 1-inch by 8 threads.....	.....do.....		
	2, 1.5-inch by 6 threads.....	.....do.....		
4	Handy oilers, 0.312 ($\frac{5}{16}$) inch.....	.....do.....		
40	Handy oilers, 0.375-inch.....	.....do.....		
4	Pins, steel 0.062 (1 $\frac{1}{16}$) by 0.65-inch.....	.....do.....		
4	Taper pins, 0.135 by 1.5 inch.....	.....do.....		
1	Set hexagon nuts, special, consisting of—			
	2, 0.19-inch by 30 threads.....	.....do.....		
	2, 0.242-inch by 20 threads.....	.....do.....		
	2, 0.375-inch by 16 threads.....	.....do.....		
1	Quick return mechanism, consisting of—			
	2 bushings.....	.....do.....		
	1 pawl, left.....	.....do.....		
	1 pawl, right, with handle riveted on.....	.....do.....		
	2 plungers with split pins.....	.....do.....		
	1 pawl shaft with washer and nut.....	.....do.....		
	2 pawl springs.....	.....do.....		
7	Spade edge rivets.....			
1	Set split pins, consisting of—			
	2, 0.046 ($\frac{5}{16}$) by 0.312 ($\frac{5}{16}$) inch.....	Carried equally in the leather pouches for spare parts.		
	6, 0.062 ($\frac{5}{16}$) by 0.562 ($\frac{9}{16}$) inch.....	.....do.....		
	6, 0.062 ($\frac{5}{16}$) by 0.75 inch.....	.....do.....		
	4, 0.093 ($\frac{5}{16}$) by 0.5 inch.....	.....do.....		
	4, 0.093 ($\frac{5}{16}$) by 0.75 inch.....	.....do.....		
	32, 0.093 ($\frac{5}{16}$) by 1 inch.....	.....do.....		
	24, 0.125 by 0.75 inch.....	.....do.....		
	8, 0.125 by 0.875 inch.....	.....do.....		
	16, 0.125 by 1 inch.....	.....do.....		
	90, 0.125 by 1.25 inch.....	.....do.....		
	12, 0.156 ($\frac{5}{16}$) by 1 inch.....	.....do.....		
	82, 0.156 ($\frac{5}{16}$) by 1.5 inch.....	.....do.....		
	4, 0.156 ($\frac{5}{16}$) by 2.25 inch.....	.....do.....		
	24, 0.203 ($\frac{11}{32}$) by 1.5 inch.....	.....do.....		
	20, 0.203 ($\frac{11}{32}$) by 2 inch.....	.....do.....		

Statement of total equipment of one 6-inch howitzer battery—Continued.

War footing (4 guns and 12 cais- sons).	Article.	Location, etc.	Property classification.	
			Class.	Sec- tion.
	SPARE PARTS FOR HOWITZERS AND HOWITZER CARRIAGES—continued.			
	<i>Additional parts supplied with model of 1908 M1 carriages only—Continued.</i>			
	Set split pins, consisting of—Continued.			
	4, 0.203 ($\frac{1}{16}$) by 2.25 inch.....	Carried equally in the leather pouches for spare parts.		
	8, 0.25 by 1.25 inch.....	.....do.....		
	8, 0.25 by 2.5 inch.....	.....do.....		
	4, 0.25 by 3 inch.....	.....do.....		
4	Spring covers No. 1, with screws and washers.	In chest for miscellaneous spare parts.	IV	3
4	Spring covers No. 3.....	.....do.....		
2	Vent plugs, with gasket.....	.....do.....		
	ACCESSORIES FOR HOWITZER CARRIAGE LIMBER, MODEL OF 1905.			
1	Cyclometer.....	On one of the 4 limbers.....	IV	9
8	Dust guards.....	On wheels.....	IV	3
4	Neck yoke, complete.....	On limbers.....		
8	Singletree, complete.....	.....do.....		
4	Pole props.....	.....do.....	IV	9
4	Spare connecting poles, complete.....	.....do.....	IV	3
16	Watering buckets, canvas.....	.....do.....	IV	9
20	Straps.....	.....do.....		
	<i>Spare parts for howitzer-carriage limber.</i>			
2	Doubletree hooks with screws and nuts.....	In store wagon, compartment "D".....		
1	Doubletree pivot with nut.....	In chest for miscellaneous spare parts		
1	Hub liner.....	In store wagon, compartment "A".....		
1	Lock washer.....	In store wagon, compartment "F".....		
1	Singletree.....	In store wagon, compartment "K".....		
1	Wheel, complete.....	On store wagon, the hub cap in compartment "F," store wagon.....		
1	Wheel fastening.....	In chest for miscellaneous spare parts	IV	3
	TOOLS AND ACCESSORIES FOR CAISSON LIMBER, MODEL 1909 AND 1916.			
12	Axes.....	In ax brackets.....	IV	9
24	Dust guards.....	On wheels.....	IV	3
12	Hatchets.....	In hatchet brackets.....		
12	I lanterns.....	In lantern brackets.....	IV	9
12	I-lantern-bracket pads.....	.....do.....	IV	3
12	Paulins, 12 by 12 feet.....	On top of chests.....		
12	Pickaxes.....	.....do.....	IV	9
12	Picket ropes.....	On front of chests.....		
12	Pole props.....	In pole-prop brackets.....	IV	3
12	Shot tongs.....	In shot-tongs pockets.....		
12	Shovels, long-handled.....	In shovel supports.....	IV	9
12	Spanners (60-inch wheels).....	In spanner brackets.....		
24	Watering buckets, canvas.....	In bucket holders.....	IV	3
12	Wrenches, 0.625 by 50.75.....	In wrench brackets.....	IV	9
12	Neck yoke, complete.....	On pole.....		
24	Singletree, complete.....	On doubletree.....		
264	Straps (6-inch howitzer limber, model of 1909).....	On vehicle.....	IV	3
12	I lantern strap.....	On lantern bracket.....		
84	Cartridge-case carrier.....	In limber chest.....		
276	Straps (6-inch howitzer limber, model of 1916).....	On vehicle.....		
	<i>Spare parts for caisson limber, model 1909 and 1916.</i>			
2	Doubletrees.....	In store wagon, compartment "H".....		
2	Doubletree pivots with nuts.....	In chest for miscellaneous spare parts		
2	Doubletree hooks with screws and nuts.....	.....do.....		
2	Hub caps, complete.....	In store wagon, compartment "F".....		
4	Hub latches.....	In chest for miscellaneous spare parts		
4	Hub-latch pins.....	.....do.....		
4	Hub-latch plungers.....	.....do.....		
4	Hub-latch springs.....	.....do.....		
2	Hub liners.....	In store wagon, compartment "A".....		

Statement of total equipment of one 6-inch howitzer battery—Continued.

War footing (4 guns and 12 caissons).	Article.	Location, etc.	Property classification.			
			Class.	Sec- tion.		
TOOLS AND ACCESSORIES FOR CAISSON LIMBER, MODEL 1909 AND 1916—continued.						
<i>Spare parts for caisson limber, model 1909 and 1916—Continued.</i>						
2	Limber-prop chains	In store wagon, compartment "K" ..				
2	Lock washers	In store wagon, compartment "F" ..				
2	Neck yokes	In battery wagon, compartment "K" ..				
2	Padlocks, chains, clevises, and bolt snaps	In chest for miscellaneous spare parts ..				
1	Pintle, with bearing, complete	In store wagon, compartment "A" ..				
2	Pintle-bearing bolts, with nuts	In chest for miscellaneous spare parts ..				
1	Pintle latch	In store wagon, compartment "K" ..				
2	Pintle-latch springs	In chest for miscellaneous spare parts ..				
2	Pintle springs with bolt and nut	do ..				
2	Poles, complete	On battery wagon ..				
2	Pole props	In store wagon, compartment "K" ..				
1	Picket rope	In battery wagon, compartment "K" ..				
3	Singletrees	In store wagon, compartment "H" ..				
1	Shot tongs	do ..				
2	Wheels, complete	On store wagon, the hub caps in compartment "H," store wagon ..				
2	Wheel fastenings, complete	In chest for miscellaneous spare parts ..				
1	Wheel hook	In store wagon, compartment "K" ..				
TOOLS AND ACCESSORIES FOR CAISSON, MODEL OF 1909 AND 1916.						
12	Axes	In ax brackets ..				
24	Dust guards	On wheels ..	IV	9		
12	Hatches	In hatchet brackets ..	IV	3		
12	Lanterns	In lanterns bracket ..	IV	9		
12	I lantern-bracket pads	do ..				
12	Oil cans	Between intermediate plates of chests ..				
12	Lantern strap	On lantern bracket ..	IV	3		
84	Cartridge-case carrier	In caisson chest ..				
12	Paulins, 12 by 12 feet	On top of chests ..				
12	Picket ropes	do ..				
12	Pick mattocks	do ..				
12	Shot tongs	In shot-tongs pockets ..	IV	9		
12	Shovels, short-handled	In shovel supports ..				
24	Watering buckets, canvas	In bucket holders ..				
192	Straps (6-inch howitzer caisson, model of 1916)	On caisson ..				
204	Straps (6-inch howitzer caisson, model of 1909)	do ..	IV	3		
<i>Spare parts for caissons, model of 1909 and 1916.</i>						
3	Apron hinges with pins	In chest for miscellaneous spare parts ..				
1	Apron latch, complete	In store wagon, compartment "C" ..				
2	Apron latch bases with washers and split pins	In store wagon, compartment "H" ..				
2	Apron latch springs	In chest for miscellaneous spare parts ..				
2	Brake levers with catches	In store wagon, compartment "K" ..				
12	Brake shoes	In store wagon, compartment "H-K" ..				
6	Brake-shoe pins	In chest for miscellaneous spare parts ..				
1	Caisson prop	In store wagon, compartment "K" ..				
12	Connecting poles, complete	In connecting pole brackets ..				
12	Connecting pole keys	In key brackets ..				
3	Hub liners	In store wagon, compartment "A" ..				
3	Lock washers	In store wagon, compartment "D" ..				
1	Lunette	In store wagon, compartment "A" ..				
2	Lunette pins	In chest for miscellaneous spare parts ..				
2	Padlocks, chains, clevises, and bolt snaps	do ..				
1	Pintle, with bearing, complete	In store wagon, compartment "A" ..				
2	Pintle-bearing bolts, with nuts	In chest for miscellaneous spare parts ..				
1	Pintle latch	In store wagon, compartment "K" ..				
2	Pintle-latch springs	In chest for miscellaneous spare parts ..				
2	Pintle springs, with bolts and nuts	do ..				

Statement of total equipment of one 6-inch howitzer battery—Continued.

War
footing
(4 guns
and 12
caissons).

	Article.	Location, etc.	Property classification.			
			Class.	Section.		
TOOLS AND ACCESSORIES FOR CAISSON, MODEL OF 1909 AND 1916—continued.						
<i>Spare parts for caissons, model of 1909 and 1916—Continued.</i>						
1	Set split pins, consisting of:					
	10, 0.093 ($\frac{3}{32}$) by 0.75 inch.....	In chest for miscellaneous spare parts				
	50, 0.093 ($\frac{3}{32}$) by 0.875 inch.....	do				
	82, 0.093 ($\frac{3}{32}$) by 1 inch.....	do				
	5, 0.125 by 0.75 inch.....	do				
	8, 0.125 by 1 inch.....	do				
	35, 0.125 by 1.25 inch.....	do				
	6, 0.156 ($\frac{5}{32}$) by 1 inch.....	do				
	5, 0.156 ($\frac{5}{32}$) by 1.25 inch.....	do				
	72, 0.156 ($\frac{5}{32}$) by 1.5 inch.....	do				
	3, 0.203 ($\frac{1}{4}$) by 1.25 inch.....	do				
	12, 0.203 ($\frac{1}{4}$) by 1.5 inch.....	do				
	2, 0.25 by 1 inch.....	do				
	2, 0.25 by 2.5 inch.....	do				
	8, 0.25 by 3.25 inch.....	do				
1	Shot tongs.....	In store wagon, compartment "K".				
3	Wheels, complete.....	In reserve.....				
3	Wheel fastenings, complete.....	In chest for miscellaneous spare parts				
TOOLS AND ACCESSORIES FOR FORGE LIMBER.						
1	Ax.....	In ax brackets.....	IV			
2	Dust guards.....	On wheels.....	IV			
1	Grindstone, with frame, complete.....	In grindstone packing fixtures.....	IV	9		
1	Hatchet.....	In hatchet brackets.....				
1	Hub liner driving tool.....	In chest.....	IV	3		
1	Lantern.....	In lantern bracket.....	IV	9		
1	Lantern bracket pad.....	do.....	IV	3		
2	Lever jacks, 3-ton.....	In lower compartment.....				
1	Paulin, 12 by 12 feet.....	On lid.....	IV	9		
1	Pickax.....	On right side of chest.....				
1	Picket rope.....	On chest.....				
1	Pole prop.....	Under foot rest.....	IV	3		
1	Rope, 1-inch manila, 150 feet.....	In chest.....	IV	9		
1	Set blacksmith's tools (field battery, heavy, as enumerated below).	do.....	X	9		
1	Shovel, short-handled.....	On left side of chest.....				
1	Snatch block, for 1.25 rope.....	In chest.....	IV	9		
1	Tackle block, 8-inch double.....	do.....				
4	Watering buckets, canvas.....	do.....				
1	Wrench (for grindstone).....	With grindstone.....				
1	Neck yoke, complete.....	On pole.....				
2	Singletree, complete.....	On doubletree.....	IV	3		
14	Straps.....	On limber.....				
1	Lantern strap.....	On lantern bracket.....				
TOOLS AND ACCESSORIES FOR BATTERY WAGON.						
1	Bore sight, breech.....	In chest for spare sights.....	IV	3		
1	Bore sight, muzzle.....	do.....				
1	Chest, carpenter's, with tools (as enumerated below).	In compartment "B".....	X	9		
1	Chest for duplex chain block.....	In compartment "A".....	IV	9		
1	Chest for spare breech mechanism.....	do.....				
1	Chest for spare sights.....	do.....	IV	3		
1	Chest, saddler's, with tools (as enumerated below).	In compartment "B".....	X	9		
1	Duplex chain block, Y. & T., 2 tons.....	In chest in compartment "A".....	IV	9		
2	Dust guards.....	On wheels.....	IV	3		
1	Forge coal bag.....	In compartment "A".....	IV	9		
1	Paulin, 12 by 12 feet.....	In compartment "B".....				
1	Retracing chain.....	In chest for duplex chain block.....				
2	Spare wheel hub covers.....	On spare wheels.....	IV	3		
1	Testing level and chest.....	In compartment "A".....	IV	9		
1	Trial chain.....	In chest for duplex chain block.....				
1	Vise.....	On right side rail.....	X	9		
2	Watering buckets, galvanized steel.....	Over duplex chain block.....	IV	9		
1	Strap.....	On battery wagon.....	IV	3		
1	Vise handle strap.....	do.....				

Statement of total equipment of one 6-inch howitzer battery—Continued.

War footing (4 guns and 12 caissons).	Article.	Location, etc.	Property classification.	
			Class.	Sec- tion.
TOOLS AND ACCESSORIES FOR STORE LIMBER.				
1 Ax..	In ax brackets.	IV	9	
2 Dust guards..	On wheels.	IV	3	
2 Filling funnels, cylinder.	In chest.			
1 Hatchet..	In hatchet brackets.	IV	9	
1 Lantern..	In lantern bracket.			
1 Lantern bracket pad..	do.			
4 Oil cans, 5-gallon..	In lower compartment.	IV	3	
2 Oil cans, 7.5-gallon..	In rear intermediate section.			
1 Paulin, 12 by 12 feet..	On lid.			
1 Pickax..	In pickax bracket.	IV	9	
1 Picket rope..	In forward intermediate compartment.			
1 Pole prop..	Under foot rest.	IV	3	
1 Shovel, short-handled..	In shovel supports.	IV	9	
4 Watering buckets, canvas..	In forward intermediate compartment.			
2 Filling funnel, cylinder (for 6-inch howitzer, model of 1908 M.).	In chest.	IV	9	
1 Neck yoke, complete..	On pole.			
2 Singletree, complete..	do.	IV	3	
11 Straps..	On limber.			
1 Lantern strap..	On lantern.			
TOOLS AND ACCESSORIES FOR STORE WAGONS.				
20 Bolos..	In compartment "A".	VII	5	
20 Bolo scabbards..	do.			
1 Chest for cleaning matériel and small stores.	In compartment "B".	IV	3	
1 Chest for miscellaneous spare parts..	do.			
1 Crowbar..	In compartment "H".	IV	9	
2 Dust guards..	On wheels.	IV	3	
1 Marking outfit, for stamping leather..	In chest for cleaning material and small stores.	X	5	
1 Marking outfit, for stamping metal..	do.			
1 Ordnance Department insignia stencil..	do.			
1 Paulin, 12 by 12 feet..	In compartment "B".	IV	9	
1 Seal stamp..	In chest for cleaning material and small stores.	X	5	
1 Slush brush..	In compartment "H".	IV	3	
2 Spare staff coupling caps..	do.	IV	9	
2 Spare wheel-hub covers..	On spare wheels.	IV	3	
1 Stencil outfit..	In chest for cleaning material and small stores.	X	5	
MISCELLANEOUS ACCESSORIES.				
4 Ax helves..	In store wagon, compartment "K".	IV	9	
4 Hatchet handles..	do.	IV	3	
3 Padlocks, with chains, clevises, and bolt snaps..	In chest for miscellaneous spare parts.			
4 Pickax handles..	In store wagon, compartment "K".			
2 Shovel handles, long..	In store wagon, compartment "H".	IV	9	
3 Shovel handles, short..	In store wagon, compartment "K".			
SIGHTS.				
4 Panoramic sights..	In case on rear of main shield.			
4 Sight, complete..	In sight fastening on carriage.			
4 Teat wrenches for panoramic sights..	In left trail box.	IV	3	
SPARE SIGHTS.				
1 Panoramic sight..	In chest for spare sights.			
1 5-inch panoramic sight extension..	do.			
1 Sight, complete..	do.			
1 Sight wrench..	do.			
1 Teat wrench and screw driver combined..	do.			
RANGE-FINDING AND FIRE-CONTROL EQUIPMENT.				
1 Aiming circle..				
1 Aiming circle tripod..				
10 Battery commander's rulers, wooden..	In store limber.			
2 Battery commander's telescope and mount..	1 on pack horse; 1 in store limber.			
2 Battery commander's telescope tripod..	do.			
1 Case for aiming circle..	On pack horse.			
1 Case for aiming circle tripod..	do.			

Statement of total equipment of one 6-inch howitzer battery—Continued.

War footing (4 guns and 12 cais- sons).	Article.	Location, etc.	Property classification.	
			Class.	Sec- tion.
RANGE-FINDING AND FIRE-CONTROL EQUIPMENT—continued.				
1	Case for battery commander's telescope and mount containing—			
	1 camel's-hair brush.....	1 in store limber.....		
	1 pin wrench.....	do.....		
	1 screw driver.....	do.....		
	1 teat wrench.....	do.....		
2	Case for battery commander's telescope tripod.	do.....		
1	Case for range finder.....			
1	Case for range-finder tripod.....			
2	Chains for time-interval recorders.....	In upper compartment, store limber.....		
1	One-meter base range finder.....	On pack horse.....		
1	One-meter base range finder tripod.....	do.....		
5	Flash lights with hood.....	In upper compartment, store limber.....		
16	Flashlights without hood.....	do.....		
1	Reel for caisson.....	On caisson chest.....		
1	Tape, steel, 100 feet.....	do.....		
2	Time-interval recorders.....	do.....		
1	Map and plotting board.....	Where convenient.....		
1	Observation tower.....	On caisson in the fifth section.....		
2	Prismatic compass.....			
6	Protractor xyloline.....	Where convenient.....		
1	Ruler for solution of triangles.....			
(Furnished by Signal Corps.)				
1	Battery case (containing 6 dry cells).....	In upper compartment, store limber.....	V	1
3	Buzzers, service, complete.....	do.....		
4	Connectors, buzzer, type "A".....	do.....		
4	Connector studs, 19-point.....	do.....		
6	Cords, buzzer.....	do.....		
6	Glasses, field, type "EE".....	do.....		
8	Kits, flag, combination, Artillery.....	do.....		
3	Kits, inspector's pocket, each containing—			
	1 electrician's knife.....	do.....		
	1 file, 3-inch.....	do.....		
	1 pair scissors.....	do.....		
	1 pair tweezers.....	do.....		
	1 pliers, 5-inch.....	do.....		
	1 rule, 2-foot.....	do.....		
	1 screw driver.....	do.....		
1	Plug, buzzer.....	do.....		
2	Reels, hand.....	do.....		
4	Rods, ground, type "D".....	do.....		
1	Wire, buzzer, one-half mile.....	do.....		
2	Megaphones.....	Carried by men.....		
HARNESS.				
55	Harness, lead, sets.....	On horses, 1 is spare.....		
19	Harness, wheel, sets.....	do.....		
74	Harness sacks.....	Not carried in field.....		
11	Pack harness, special pack equipment.			
SPARE PARTS FOR HARNESS.				
8	Breast straps.....	In battery wagon, compartment "K".....	IV	8
2	Bridles and bits, Artillery.....	do.....		
16	Cinchas, Artillery, lead.....	do.....		
8	Cinchas, Artillery, wheel.....	In battery wagon, 2 in compartment "J," 3 in compartment "K".....		
5	Collars, steel, with 2 home tugs each.....	In battery wagon, compartment "J".....		
27	Collar pads.....	do.....		
10	Collar straps.....	do.....		
20	Curb bits.....	In battery wagon, compartment "K".....		
20	Curb chains with hooks.....	do.....		
10	Feed bags.....	do.....		
10	Grain bags.....	do.....		
8	Halter headstalls.....	do.....		
25	Halter tie ropes.....	In battery wagon, compartment "H".....	IX	5

¹ This set of pack harness and special pack equipment will be issued to carry the fire-control equipment until the reel, 2-horse, is available.

² Not part of harness.

Statement of total equipment of one 6-inch howitzer battery—Continued.

War footing (4 guns and 12 cais- sons).	Article.	Location, etc.	Property classification.				
			Class.	Sec- tion.			
SPARE PARTS FOR HARNESS—continued.							
8	Martingales, with cincha straps.....	In battery wagon, compartment "K."					
5	Mogul springs.....	In battery wagon, compartment "G."					
8	Side strap for breeching.....	In battery wagon, compartment "K."					
16	Stirrup straps.....	do.....	IV	8			
10	Traces, lead, with chains.....	In battery wagon, compartment "A"					
5	Traces, wheel.....	do.....					
5	Whips, artillery.....	In battery wagon, compartment "K."					
SPARE PARTS FOR STEEL COLLARS.							
8	Bolts for bottom of collars, with nuts.....	In chest for miscellaneous spare parts					
8	Bolts for extensions, with nuts.....	do.....					
8	Bolts for top connections, with nuts.....	do.....					
8	Bolts for trace plates, with nuts and washers.....	do.....					
3	Buckle latches.....	do.....	IV	8			
8	Buckle springs.....	do.....					
5	Draft springs.....	do.....					
8	Pad bolts, with nuts.....	do.....					
8	Pad hooks, with collar back-strap connections.....	do.....					
3	Trace plates and loops.....	do.....					
INSTRUCTION EQUIPMENT.							
1	Shell, sectionalized.....	Not carried in field.....	V	4			
1	Shrapnel, sectionalized.....	do.....					
MISCELLANEOUS EQUIPMENT.							
3	Arm racks, pistol.....	Not carried in field.....	X	1			
8	Cartridge cases.....	In ammunition chests.....					
8	Drill projectiles, with the following spare parts:						
	1 fixed stop-pin screw	Carried in ammunition chest for peace footing; not carried for war footing.	IV	5			
	1 graduating time-train ring.....	do.....					
	8 rotating pins with stop pins.....	do.....					
1	Set of decapping, cleaning, and priming tools, consisting of 1 chest for storage of reloading and cleaning outfits, containing—						
	1 bushing.....	In store wagon, compartment "K" ..					
	1 case holder.....	do.....	V	5			
	1 case-holder stand.....	do.....					
	1 cleaning brush.....	do.....					
	1 decapping tool.....	do.....					
	1 hammer.....	do.....					
	1 large primer-inserting press.....	do.....					
	1 saluting-powder measure.....	do.....					
1	Pistol-cleaning kit.....	Where convenient.....	X	9			
AMMUNITION.							
269	Shell, rounds.....	In ammunition chests.....	VI	3			
167	Shrapnel, rounds.....						
PERSONAL EQUIPMENT.							
The equipment of the enlisted men of Field Artillery will be as follows:							
(a) For each enlisted man—							
1	Bacon can, model of 1913.....	Carried by man	IX	1			
1	Canteen, model of 1910.....	do.....					
1	Canteen cover, dismounted, model of 1910.....	do.....					
21	Cartridges, ball, pistol.....	do.....	VII	2			
1	Cup, model of 1910.....	do.....					
1	Fork.....	do.....					
1	Knife.....	do.....					
2	Magazines, pistol, extra.....	do.....	VII	2			

Statement of total equipment of one 6-inch howitzer battery—Continued.

War footing (4 guns and 12 cals- sons).	Article.	Location, etc.	Property classification.	
			Class.	Sec- tion.
PERSONAL EQUIPMENT—continued.				
1	(a) For each enlisted man—Continued.			
1	Meat can.....	Carried by man.....	IX	1
1	Pistol.....	do.....	VII	2
1	Pistol belt without saber ring.....	do.....		
1	Pistol holster.....	do.....		3
1	Pouch for first-aid packet.....	do.....		
1	Spoon.....	do.....		1
1	First-aid packet (medical depart- ment).	do.....		
(Furnished by Quartermaster Corps.)				
1	Identification tag.....	do.....		
1	Shelter tent, half.....	do.....		
5	Shelter-tent pegs.....	do.....		
1	Shelter-tent pole.....	do.....		
1	(b) For each enlisted man individually mounted in addition to (a)—			
1	Bridle, Field Artillery.....	On horse.....		
1	Currycomb.....	do.....		
1	Horse brush.....	do.....		
1	Link.....	do.....		
1	Saddle, McClellan, Field Artillery.....	do.....		
1	Saddlebags, pair.....	do.....		
1	Spurs, pair.....	do.....		
1	Spur straps, set.....	Carried on man.....		2
1	(c) For each driver, in addition to (a)—			
1	Currycomb.....	On horse.....		
1	Horse brush.....	do.....		
1	Spurs, pair.....	Carried on man.....		2
1	Spur straps, set.....	do.....		
1	(d) For each gunnery, not mounted, in addition to (a)—			
1	Condiment can.....	do.....		
1	Haversack, model of 1910.....	do.....		1
HORSE EQUIPMENT.				
The following equipments are pre- scribed for each horse of the Field Artillery:				
1	Feed bag.....	Carried on horse.....		
1	Grain bag.....	do.....		
1	Halter headstall.....	do.....		
1	Halter tie rope.....	do.....		
1	Saddle blanket.....	do.....		
1	Surcingle.....	do.....		
1	Horse cover.....	Not carried in field.....		
CONTENTS OF SADDLER'S CHEST.				
12	Awl blades, harness, assorted.....	In saddler's chest, battery wagon.....		
1	Awl, pegging.....	do.....		
1	Awl, seat, handled.....	do.....		
1	Carriage, pricking, 3 wheels, Nos. 7, 8, and 10.....	do.....		
1	Compass, 6-inch.....	do.....		
1	Creaser, double.....	do.....		
1	Edge tool, No. 1.....	do.....		
1	Edge tool, No. 2.....	do.....		
2	Extra blades, with followers for draw gauge.....	do.....		
1	Gauge, draw, brass.....	do.....		
2	Hafts, awl, with wrench.....	do.....		
1	Hammer, riveting, No. 3.....	do.....		
1	Handle, pegging awl, with wrench.....	do.....		
1	Knife, round.....	do.....		
1	Knife, splitting, 6-inch.....	do.....		
1	Needle case, leather.....	do.....		
1	Nippers, cutting, 10-inch.....	do.....		
1	Oil stone, unmounted.....	do.....		
1	Paper glovers' needles, No. 3.....	do.....		
2	Papers harness needles, No. 4.....	do.....		
2	Papers harness needles, No. 5.....	do.....		
2	Papers harness needles, No. 6.....	do.....		
12	Papers sacking needles, Nos. 4 and 4½, as- sorted.....	do.....		

Statement of total equipment of one 6-inch howitzer battery—Continued.

War footing (4 guns and 12 cais- sons).	Article.	Location, etc.	Property classification.	
			Class.	Sec- tion.
CONTENTS OF SADDLER'S CHEST—contd.				
1 Pliers, 6-inch.		In saddler's chest, battery wagon.		
4 Punches, hand, Nos. 5, 7, 8, and 10, round.		do.		
1 Punch, revolving, 4 tubes, Nos. 4, 5, 6, and 7.		do.		
1 Rivet set.		do.		
1 Rule, boxwood, 2-foot, 4-fold.		do.		
1 Screw driver, 3-inch blade.		do.		
1 Sewing palm.		do.		
1 Shears, 10-inch.		do.		
1 Shoe knife, broad point.		do.		
1 Shoe knife, square point.		do.		
1 Slicker, steel.		do.		
2 Thimbles.		do.		
1 Tool, claw.		do.		
CONTENTS OF CARPENTER'S CHEST.				
1 Ax, bench.		In carpenter's chest battery wagon.		
2 Bags, canvas, for small stores.		do.		
1 Bevel, 8-inch.		do.		
6 Bits, auger, sizes $\frac{1}{2}$, $\frac{3}{4}$, $\frac{1}{4}$, 1 inch, $\frac{1}{2}$ and $1\frac{1}{2}$ inches.		do.		
1 Bit, expansive, two cutters $\frac{1}{2}$ to 3 inches.		do.		
1 Bit, wood countersink, $\frac{1}{4}$ -inch diameter.		do.		
3 Bits, screw driver, size $\frac{1}{2}$, $\frac{3}{4}$, and $\frac{1}{4}$ inch.		do.		
1 Brace, ratchet, 10-inch sweep.		do.		
3 Chisels, socket, framing, sizes, $\frac{1}{4}$, 1, and $1\frac{1}{2}$ inches.		do.		
1 Divider, wing, 10-inch.		do.		
4 Drills, twist, sizes $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{32}$ and $\frac{1}{64}$ inch.		do.		
1 File, 10 saw, flat bastard.		do.		
6 Files, saw, sizes 4 and 6 inches.		do.		
1 Gage, marking.		do.		
2 Gouges, socket firmer, sizes $\frac{1}{2}$ and 1 inch.		do.		
1 Hammer, claw.		do.		
2 Handles, file.		do.		
1 Handle, tool, containing 10 tools.		do.		
1 Knife, drawing, 9-inch blade.		do.		
1 Mallet.		do.		
1 Nail set.		do.		
1 Oiler.		do.		
1 Oil stone, unmounted.		do.		
1 Pincers, small, 8-inch.		do.		
1 Plane, jack, 16-inch.		do.		
1 Plane, smoothing, 8-inch.		do.		
1 Plate, auger handle.		do.		
1 Rasp, wood, 10-inch.		do.		
1 Reamer, half round.		do.		
1 Rule, boxwood, 2-foot, four-fold.		do.		
1 Saw, crosscut, 24-inch, 7-point.		do.		
1 Saw, rip, 24-inch, 5-point.		do.		
1 Saw set.		do.		
1 Screw driver, 5-inch blade.		do.		
1 Spoke shave.		do.		
1 Square, steel.		do.		
1 Tape, linen, 100-foot.		do.		
1 Vise, table, $2\frac{1}{2}$ inch jaw.		do.		
1 Wrench, screw, 12-inch.		do.		
BLACKSMITH'S TOOLS.				
1 Anvil, 100-pound.		In forge limber chest.		
2 Aprons.		do.		
2 Bags, canvas, for nails.		do.		
1 Box, leather shoeing.		do.		
1 Chisel, cold, 8-inch.		do.		
1 Chisel, handled, for cold iron.		do.		
1 Chisel, handled, for hot iron.		do.		
1 Clinching iron.		do.		
1 Cutting nippers.		do.		
6 Drills, flat.		do.		
1 File, 12-inch flat bastard.		do.		
1 Fire rake.		do.		
1 Fire shovel.		do.		
1 Flatter, handled.		do.		
1 Fore punch and creaser.		do.		

X 9

X 9

X 9

Statement of total equipment of one 6-inch howitzer battery—Continued.

War footing (4 guns and 12 cais- sons).	Article.	Location, etc.	Property classification.	
			Class.	Sec- tion.
BLACKSMITH'S TOOLS—continued.				
1	Forge, Empire, portable.....	In forge limber chest.....		
1	Hammer, hand, 2-pound.....	do.....		
1	Hammer, riveting, 1-pound 2-ounce.....	do.....		
1	Hammer, shoeing, 10-ounce.....	do.....		
1	Handle, file, aluminum.....	do.....		
1	Hardie, 0.75 square shank, 1.25 bit.....	do.....		
1	Oiler.....	do.....		
1	Pritchel, 0.75 flats.....	do.....		
1	Punch, nail.....	do.....		
1	Punch, round, 0.312 ($\frac{1}{8}$) diameter.....	do.....		
1	Punch, round, 0.375 diameter.....	do.....		
1	Punch, square.....	do.....		
1	Ratchet drill for square shank drills.....	do.....		
5	River sets, sizes $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$ and $\frac{1}{2}$ inch.....	do.....		
1	Rule, boxwood, 2-foot, four-fold.....	do.....		
1	Screw plate, taps and dies, with tap wrench, including chest.....	do.....		
2	Shoeing knives.....	do.....		
1	Shoeing pincer, 14-inch.....	do.....		
1	Shoeing rasp, 16-inch.....	do.....		
1	Sledge, 11-pound.....	On forge limber.....		
1	Square.....	In forge limber chest.....		
1	Toe knife.....	do.....		
1	Tongs, horseshoer's.....	do.....		
1	Tongs, for 0.25 iron.....	do.....		
1	Tongs, for 0.5 iron.....	do.....		
1	Vise.....	do.....		
1	Whetstone, farrier's, 10-inch.....	do.....		
1	Wrench, forge.....	do.....		
1	Wrench, screw.....	do.....		

War footing (4 guns and 12 cais- sons).	Article.	Where carried.	Property classification.			
			In store.	Class.		
MATERIALS FOR CLEANING AND PRESERVATION.						
(Six months' supply, all expendable.)						
5	Borax, pounds.....	In battery wagon, compartment "J.".....				
1	Brush, camel's-hair, No. 1 round.....	In chest for cleaning material and small stores.....				
3	Brushes, sash, No. 3.....	do.....				
3	Brushes, sash, No. 5.....	do.....				
1	Brush, varnish, No. 4-0.....	In battery wagon, compartment "J.".....				
2	Brushes, varnish, No. 5-0.....	do.....				
2	Brushes, varnish, No. 6-0.....	do.....				
2	Burners, lantern.....	In chest for cleaning material and small stores.....				
2	Chamois skins.....	do.....	1			
2	Cloth, crocus, quires.....	1 in chest for cleaning material and small stores.....	1			
1	Cloth, emery, No. 00, quire.....	do.....				
1	Cloth, emery, No. 0, quire.....	do.....				
1	Cloth, emery, No. $\frac{1}{2}$, quire.....	do.....				
2	Cosmic, No. 80, soft, quarts.....	In store wagon, compartment "J.".....	2			
6	Dressing, russet leather, boxes.....	3 in chest for cleaning material and small stores, 1 in store wagon, compartment "J.".....				
2	Globes, lantern.....	In chest for cleaning material and small stores.....				
*7	Lavaline, 16-oz. cans.....	In store wagon, compartment "J.".....				
25	Lye, powdered, pounds.....	5 in store wagon, compartment "J.".....	20			
15	Naphthaline, pounds.....	In cans on store limber.....	15			
5	Oil, coal, gallons.....	In cans on store limber.....				

*Only one of these items will be issued to an organization.

Statement of total equipment of one 6-inch howitzer battery—Continued.

War footing (4 guns and 12 cais- sons).	Article.	Where carried.	In store.	Property classification.	
				Class.	Sec- tion.
MATERIALS FOR CLEANING AND PRESERVATION—continued.					
1	Oil, clock, ounce.....	In chest for cleaning material and small stores.			
15	Oil, hydroline, gallons.....	In cans on caissons and store limber.			
8	Oil, linseed, boiled, gallons.....	1 in store wagon, compartment "J,"	7		
1	Oil, linseed, raw, pint.....	In chest for cleaning material and small stores.			
15	Oil, lubricating (engine No. 1), gallons.....	In cans on caissons and store limber.			
25	Oil, neat's-foot, gallon.....	6 in store limber, compartment "J,"	19		
5	Oil, slushing, light, gallons.....	2 in store limber, compartment "J,"	3		
2	Oil, sperm, gallons.....	1 in store limber, compartment "J,"	1		
100	Paint, olive-drab, second coat, pounds.....	5 in store limber, compartment "J,"	95		
100	Paint, olive-drab, third coat, pounds.....	do.....	95		
5	Paint, rubberine, gallons.....	do.....	5		
5½	Petrolatum (vaseline), ounces (in tin box).....	In chest for cleaning material and small stores.			
*7	Polish, Gibson's soap, 16-ounce cans.....	In store wagon, compartment "J,"			
6	Primer, brown enamel, quarts.....		3		
100	Sal soda, pounds.....	20 in chest for cleaning material and small stores.	80	X	10
1	Sandpaper, No. 2½, quires.....	In chest for cleaning material and small stores.			
1	Sandpaper, No. 1½, quires.....	do.....			
1	Sandpaper, No. ½, quires.....	do.....			
1	Sandpaper, No. 00, quires.....	do.....			
60	Soap, castile, pounds.....	In store wagon, compartment "J,"			
6	Soap, H. & H., cakes.....	do.....			
90	Soap, saddle, Frank Miller's, pounds.....	In store wagon, compartment "A,"			
75	Sponges, 5-inch.....	do.....			
10	Sponges, large, 5½ or 6 inches.....	In chest for cleaning material and small stores.			
1	Tape, black, adhesive, ¼ inch wide, ½-pound roll.....				
10	Turpentine, gallons.....	In battery wagon, compartments "J" and "G"; in store wagon, compartments "A," "G," and "H."		10	
50	Waste, white cotton, pounds.....	In chest for cleaning material and small stores.			
SADDLERS' MATERIAL.					
(Six months' supply, all expendable.)					
6	Awl blades, harness, assorted.....	In saddlers' chest.			
1	Awl haft, with wrench.....	do.....		X	9
2	Buckles, bar, 1-inch, Saalbach.....	In canvas bag for small stores, battery wagon.			
9	Buckles, bar, ¾-inch, tongueless.....	do.....			
15	Buckles, bar, 1-inch, tongueless.....	do.....			
6	Buckles, bar, ½-inch, tongueless.....	do.....			
40	Buckles, center bar, ¾-inch.....	do.....			
6	Buckles, center bar, ½-inch.....	do.....			
12	Buckles, center bar, ½-inch.....	do.....			
2	Buckles, center bar, 1-inch.....	do.....			
12	Buckles, center bar, 1½-inch.....	do.....			
12	Buckles, center bar, 1⅔-inch.....	do.....			
12	Buckles, roller, ¾-inch.....	do.....			
2	Buckles, roller, ½-inch.....	do.....			
22	Buckles, roller, ¼-inch.....	do.....			
6	Buckles, roller, 1 inch.....	do.....			
48	Buckles, roller, 1½-inch.....	do.....			
4	Buckles, roller, 1¾-inch.....	do.....			
7	Buckles, satchel, ½-inch.....	do.....			
3	Buckles, wire, ½-inch.....	do.....			
1	Buckle, wire, ¼-inch.....	do.....			
28	Buckles, wire, ¼-inch.....	do.....			
3	Cheeks "D".....	do.....			
14	Conway loops, ¾-inch.....	do.....			

* Only one of these items will be issued to an organization.

Statement of total equipment of one 6-inch howitzer battery—Continued.

War footing (4 guns and 12 cais- sons).	Article.	Where carried.	In store.	Property classification.	
				Class.	Sec- tion.
SADDLER'S MATERIAL—continued.					
23	Duck, olive-drab cotton, 2½-inch, yards.	In battery wagon, compartment "A."			
15	End buckles, 1-inch, with clip	In canvas bag for small stores, battery wagon.		X	10
28	End clips, ¾-inch	do			
21	End clips, 1-inch	do			
25	End clips, 1½-inch	do			
12	Foot staples, high	In saddler's chest		IX	5
24	Foot staples, low	do			
12	Foot staples, semicircular	do			
10	Hooks, back strap or collar strap	In canvas bag for small stores, battery wagon.		IV	8
2	Hooks, breast strap	do			
12	Hooks, double	In saddler's chest		IX	1
12	Hooks, end	do		IX	5
2	Hooks, side strap	In canvas bag for small stores, battery wagon.		IV	8
2	Hooks, wire (for links)	do		IX	5
6	Leather, bridle, sides	2 in store wagon, compartment "K"	4		
6	Leather, collar, backs	do	4		
200	Leather, harness, backs, pounds	50 in store wagon, compartment "K"	150	X	10
1	Leather, latigo, side	In battery wagon, compartment "K."			
9	Nails, saddle	In saddler's chest			
1	Needles, Glover's No. 3, paper	do		X	9
1	Needles, harness, No. 4, paper	do			
1	Needles, harness, No. 5, paper	do			
1	Needles, harness, No. 6, paper	do			
10	Ornaments, brow band	do			
10	Ovals, saddle	do		IX	5
4	Ovals, saddlebag	do			
2	Pins, screw, brass, ¼-inch, No. 2, gross	do			
12	Rings, ½ inch diameter, saddlebag	do			
24	Rings, 1½ inches diameter, saddle	do			
5	Rings, 1⅓ inches diameter, back strap	do			
9	Rings, 1⅓ inches diameter, throat strap	do			
12	Rings, 2 inches diameter, halter	In canvas bag for small stores, battery wagon.			
12	Rings, 4 inches diameter, quarter strap	do			
10	Rings, "D," 1 inch diameter, feed bag	In saddler's chest			
9	Rings, "D," 1⅓ inches diameter, with clasp	do		X	10
3	Rings, "D," 1⅔ inches diameter	do			
3	Rings, "D," 2 inches diameter (spec)	do			
2	Rivets and burs, brass, ¾-inch, No. 12, pounds	do			
1	Rivets and burs, brass, ½-inch, No. 10, pounds	do			
1	Rivets and burs, brass, ¾-inch, No. 10, pounds	do			
1	Rivets and burs, brass, 1-inch, No. 8, oval head, pound	In saddler's chest			
4	Rollers, lead rein	do		IV	8
1,260	Rope, ¼-inch, halter	In battery wagon, compartment "J."			
2	Screws, brass, wood, 1-inch, No. 6, gross	In saddler's chest			
10	Sheepskins, with wool on	2 in battery wagon, compartment "J."	8	X	10
1	Shield, saddle, 11-inch	In saddler's chest			
2	Shields, saddle, 11½-inch	do		IX	5
3	Shields, saddle, 12-inch	do			
2	Snap-hook, covert's, 1-inch	do			
2	Snap-hook, German, ¾-inch	do			
10	Snap-hook, German, 1-inch	do		X	10
6	Snap-hook, swivel, oval loop, 1⅓-inch	do			
4	Snap hooks, canteen cavalry	do		IX	5
2	Snap hooks, covert's, ¾-inch	do			
6	Snap-hook sack, 1-inch	do		IX	5

Statement of total equipment of one 6-inch howitzer battery—Continued.

War footing (4 guns and 12 cais- sons).	Article.	Where carried.	In store.	Property classification	
				Class.	Sec- tion.
SADDLER'S MATERIAL—continued.					
36	Squares, halter.....	In canvas bag for small stores, battery wagon.			
2	Strap loops, coupling, $\frac{3}{4}$ -inch (for bridle).	.....do.....		IX	5
10	Strap loops, feed bags.....	.....do.....			
5	Stud hooks.....	In saddler's chest.			
6	Studs, saddle bag.....	.....do.....			
1	Tacks, copper, No. 12, paper.....	.....do.....			
1	Tacks, copper, No. 20, paper.....	.....do.....			
1	Thimble, aluminum-lined, $\frac{3}{4}$ -inch.....	.....do.....			
1	Thread, carpet, No. 18, olive-drab, pound.	.....do.....			
1	Thread, shoe, No. 3, brown, pound.....	.....do.....		X	10
2	Wax, brown stitching, pounds.....	.....do.....			
21	Webbing, olive-drab, cotton, heavy, $\frac{3}{4}$ -inch, yards.	In battery wagon, compartment "A."			
32	Webbing, olive-drab, cotton, heavy, 1-inch, yards.	.....do.....			
14	Webbing, olive-drab, halter, $1\frac{1}{2}$ inches.	.....do.....			
18	Webbing, olive-drab, jute, $3\frac{1}{2}$ inches.	.....do.....			
FOR POLO EQUIPMENT.					
6	Buckles, girth, 1-inch.....				
2	Buckles, stirrup strap, $1\frac{1}{2}$ -inch.....				
2	Buckles, wire, $\frac{1}{2}$ -inch.....				
2	Buckles, wire, $\frac{3}{4}$ -inch.....				
12	Buckles, wire, $\frac{3}{4}$ -inch.....	Not carried.....		X	10
4	Buckles, wire, $\frac{3}{4}$ -inch.....				
4	Rings, $\frac{3}{4}$ -inch diameter.....				
5	Web, linen, straining, $3\frac{1}{2}$ -inch, yards.....				
7	Web, linen, straining, 5-inch, yards.....				

*Statement of total equipment of one 6-inch howitzer battery—Continued.*SUPPLIES KEPT IN RESERVE FOR FIELD BATTERY, HEAVY (IN STORE).¹

No.	Article.	Property classification.	
		Class.	Sec-tion.
3	Buckle, bar, tongueless, $\frac{1}{2}$ -inch.....		
5	Buckle, bar, tongueless, 1-inch.....		
12	Buckle, center bar, $\frac{1}{2}$ -inch.....		
2	Buckle, center bar, $\frac{1}{4}$ -inch.....		
4	Buckle, center bar, $\frac{1}{8}$ -inch.....		
4	Buckle, center bar, $\frac{1}{4}$ -inch.....		
4	Buckle, center bar, $\frac{1}{8}$ -inch.....		
4	Buckle, roller, $\frac{1}{2}$ -inch		
7	Buckle, roller, $\frac{1}{4}$ -inch		
12	Buckle, roller, $\frac{1}{4}$ -inch		
9	Buckle, $\frac{1}{4}$ -inch wire.....		
2	Burner, lantern, Dietz Vesta.....		
1	Cheek "D"		
1	Chamois skin. Not smaller than 13 by 17.....		
5	Conway loop, $\frac{1}{2}$ -inch.....		
4	Dressing, russet leather, boxes, 16-ounce.....		
5	End buckle.....		
2	Globe, lantern.....		
2	Hook, back strap, tool steel.....		
2	Hook, collar strap, tool steel.....		
4	Hook, double, brass wire.....		
4	Hook, end, brass wire.....		
2	Leather, bridle backs.....		
2	Leather, collar backs.....		
40	Leather, harness backs.....		
1	Leather, latigo side.....		
3	Saddle nails, $\frac{1}{2}$ -inch diameter of head.....		
1	Oil, clock, 1-ounce bottle.....		
12	Oil, hydroline, gallons.....		
20	Oil, neat's-foot, gallons.....		
2	Oil, slushing, light, gallons.....		
1	Oil, sperm, gallon.....		
4	Oil, coal, gallons.....		
12	Oil, lubricating, gallons.....		
3	Ornament, brow band copper.....		
2	Ring, $\frac{3}{4}$ -inch diameter, saddle bag.....		
8	Ring, $\frac{1}{4}$ -inch diameter, saddle.....		
4	Ring, 2-inch diameter, halter.....		
4	Ring, 4-inch diameter, cincha strap.....		
4	Ring, 4-inch diameter, quarter strap.....		
3	Ring, 1-inch diameter, feed bag.....		
1	Rivets and burs, $\frac{1}{2}$ -inch, No. 10, pounds.....		
1	Rivets and burs, $\frac{1}{4}$ -inch, No. 10, pounds.....		
25	Salsoda, pounds, bulk	IX	10
2	Snap hook, haversack		
3	Snap hook, feed bag		
12	Square, halter.....		
40	Soap, castile, pounds.....	X	10
4	Soap, H. and H., cakes or "Paco"		
60	Soap, saddle, Frank Miller's, pounds		
25	Sponges, 5-inch	IX	5
3	Strap loop, feed bag		
2	Stud, saddle bag	X	10
1	Tacks, copper, paper of 1,000, 12-ounce		
1	Tacks, copper, paper of 1,000, 20-ounce		
1	Thread, carpet, pound		
1	Thread, shoe, pound		
1	Thread, No. 10, pound		
30	Waste, cotton, pounds	X	10
1	Wax, stitching, pound		
2	Wick, lantern		

¹ No material will be drawn from this supply for making repairs and replacements except in sudden calls for field service if necessary to replace missing items of the regular supplies. To avoid deteriorations, all perishable articles should be replaced by similar ones received with the regular 6 months' allowance.

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